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Volume 16 Number 5

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Study and Treatment of Muscle Imbalance in Cases of Low Back and Sciatic Pain

Henry O. Kendall[1], and Florence P. Kendall[2]

A vast number of cases of chronic low back and sciatic pain fall into a group in which no definite etiological factor can be established, other than perhaps faulty posture. The following article deals with the mechanics of muscle imbalance in relation to this type, and describes examination and treatment directed toward establishing a balanced musculature. The material is based on the successful treatment of a large number of patients during the past six years. No single remedy is applied to all cases but the relief of symptoms depends entirely on the detailed treatment in each case.

Normal Posture and Muscle Balance

Correct body mechanics of muscles in relation to posture depends, not on the strength of the muscles, but on the balance of strength between opposing muscle groups. Before discussing faulty posture due to muscle imbalance it is necessary to describe briefly normal posture and show what muscles oppose each other in maintaining correct standing position.

The normal antero-posterior gravity line through the body is usually described as passing through the lobe of the ear, the shoulder joint, the greater trochanter of the femur, posterior to the patella, and anterior to the external malleolus. From this description it will be observed that the weight-bearing bony framework of the body is in the line of gravity, maintained in that line, obviously, by a balance between the antero-posterior and lateral muscle pulls, as a tent pole in the center of a square tent is maintained erect by an equal pull from the four corner guy ropes.

The following is a brief outline of muscles opposing each other in antero-posterior, lateral, and rotary movements of the body. (All the muscles in each movement cannot be mentioned but will be grouped according to action, or the main ones in the action will be named.)

Foot

Antero-posterior: Dorsi-flexors oppose plantar flexors.

Lateral and rotary: Tibials oppose peroneals.

Knee

Antero-posterior: Hamstrings, gastrocnemius, and popliteus oppose quadriceps.

Hip

Antero-posterior: Ilio-psoas, rectus femoris, tensor fascia lata, and sartorius oppose gluteus maximus and hamstrings.

Lateral: Unilaterally, abductors oppose adductors. Bilaterally, right abductors and left adductors oppose left abductors and right adductors.

Rotary: Unilaterally, internal rotators oppose external rotators.

Bilaterally: right internal rotators and left external rotators oppose left internal and right external rotators.

Trunk

Antero-posterior: Low back muscles oppose anterior abdominal muscles.

Lateral: Lateral abdominals oppose each other.

Rotary: Too detailed for description in this article.

Pelvis

With the pelvis pivoting on the femora, the opposing groups of muscles act not only in straight antero-posterior opposition but combine their pulls diagonally to tilt the pelvis forward or backward and laterally. There are four main groups of muscles in antero-posterior opposition:

1. Erector spinae, quadratus lumborum, and other posterior back muscles attached to the posterior superior part of the pelvis, exert an upward pull posteriorly.

2. The anterior abdominals, especially the rectus abdominis with its insertion on the symphysis pubis, and the anterior fibers of the internal and external obliques with attachment on the anterior iliac crests, exert an upward pull anteriorly.

3. The hamstrings attached to the posterior ischium exert a direct downward pull posteriorly; and the piriformis and lower fibers of the bluteus maximus with origin on the sacrum and insertion on the posterior surface of the trochanter and gluteal line, approximate the sacrum to the posterior thigh.

4. The hip flexors, including the rectus femoris, ilio-psoas, tensor fascia lata, and sartorius exert a downward pull anteriorly.

The low back muscles combine in action with the hip flexors (especially the psoas with its direct pull from the lumbar spine to the femur) to tilt the pelvis down and forward. They are opposed in action by the combined pull of the anterior abdominals pulling up anteriorly, and the hamstrings, gluteals, and piriformii pulling down

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posteriorly to level the pelvis from a position of anterior tilt.

Lateral Opposition

1. Leg abductors (mainly the gluteus minimus and medius) which arise from the lateral surface of the pelvis, pull down on the pelvis when the leg is fixed as in standing.

2. Lateral trunk muscles attached to the lateral crest of the ilium, pull up laterally on the pelvis.

The opposing leg abductors and lateral trunk muscles combine in action to tilt the pelvis laterally; that is, the right abductors will pull DOWN on the right side of the pelvis as the left lateral trunk muscles pull UP on the left side and vice versa. This action is assisted by the leg adductors on the same side as the laterals so that: right abductors, left adductors, left laterals oppose left abductors, right adductors, right laterals.

FAULTY POSTURE AND MUSCLE IMBALANCE

Types of Faulty Posture

Two outstanding types of faulty posture are described because they illustrate distinguishing features which should be observed before treating patients. However, observations made must be confirmed by a detailed muscle examination before any conclusions can be reached as to the extent of muscle imbalance. Types of posture can not be classified in such a way that examination findings will fit into certain definite patterns—each case presents its individual problems.

Faulty standing posture with elevated chest and lordosis is illustrated by Type (b), Fig. 1. This type of patient is one who frequently claims to have an excellent posture—his shoulders are back, his head is held correctly, and his chest is held high—but his pelvis is tilted forward and he has a sweeping lordosis. His aim has been to correct his posture by lifting his chest, and due to this elevation of the chest with anterior tilt of the pelvis, all the anterior abdominal musles are on a stretch, allowing the unopposed back muscles to tighten. Internal rotation of the femora, hyperextension of the knees, and pronation of the feet are frequently associated with this trunk position.

Faulty standing posture with depressed chest and lordosis is illustrated by Type (c), Fig. 1. This type of patient stands in a slumped position with depressed chest, forward head, dorsal kyphosis, abducted scapulae, and a lordosis. This depressed position of the chest allows the anterior upper abdominals to tighten and puts the upper back muscles on a stretch.

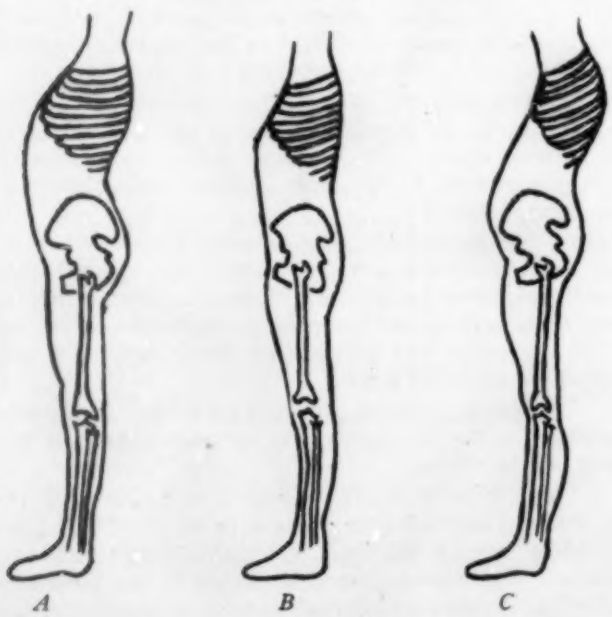

Fig. 1.

Patients frequently complain of muscle soreness in the upper back due to this stretching of the scapular muscles. The tilt of the pelvis allows the low back muscles to contract while the lower abdominals are stretched. Internal rotation of the femora and pronation of the feet are generally associated with this type also.

Both types frequently complain of aching and soreness in the posterior region of the knees and "pain under the knee-caps." The soreness is due to stretching of the gastrocnemius and popliteus as the knee hyperextends. The pain is due to joint strain in the anterior part of the joint when the knee is hyperextended.

Causes of Faulty Posture

As correct posture is maintained by muscle balance, so faulty posture results from, and causes an increase in, muscle imbalance. Whether the original strain be due to direct muscular injury or prolonged mechanical strain, it is the weakened condition of certain muscle groups which permits extreme faulty posture. As a result of the weakness over a period of time, contractures of varying degrees usually result in the muscles opposing the weakened group.

In the correct standing position with the weight-bearing bony frame-work in the gravity line, strain of weight bearing is distributed between the bony frame-work, ligamentous structures, and the musculature of the body. When any factor causes muscular imbalance in groups important in weight-bearing, the bony alignment is changed so that more than normal strain falls on various muscle groups and weight is borne abnormally on joint surfaces. Evidence of chronic strain will generally be shown by muscle soreness and fatigue before any bony changes have taken place.

Faulty posture may begin with imbalance in foot muscles. Pronation of the foot causes displacement of the weight to the medial side of the foot. Since there is no lateral motion at the knee, with the knees in extension as in standing, the leg must rotate to accommodate for the medial displacement of the weight. With internal rotation of the femur at the hip joint there is a constant strain on the external rotators of the hip (especially the piriformis), the lower fibers of the gluteus maximus which pass from the sacrum to the femur, and the posterior part of the gluteus medius. Gradually the external rotators become weakened and the internal rotators, especially the tensor fascia lata, become contracted. With the leg in internal rotation the tensor fascia lata is placed in a position more anterior than is normal in correct standing.

As it becomes contracted in this position the tensor fascia lata exerts a strong pull downward on the anterior crest of the ilium, and with the loss of tone in the posterior muscles which pull down on the sacrum, the pelvis gradually tilts forward.

Any mechanical or functional strain causing a muscle imbalance in one part of the body will soon result in a compensating imbalance in other parts of the body. The cause of the imbalance may begin with the feet or may begin with imbalance between muscles acting on the pelvis or trunk, changing the weight line of the body so that the weight in thrown abnormally on the legs and feet causing a secondary imbalance in the muscles of the

lower extremities. Undue strain on abdominal muscles, such as operation, obesity, or pregnancy, may cause the imbalance to begin with abdominal weakness. In women a great many cases of low back pain have followed child birth and many of these patients have obtained complete relief of symptoms through correction of the posture by routine treatment. In many cases in which there has been no definite abdominal strain, the back muscles have become over-developed due to occupation or posture, and weakness in the abdominals has gradually increased as a result of disuse of these muscles. In adult life very few activities require strenuous use of the abdominal muscles while almost all of our activities tend to strengthen the muscles of the back. An important factor to be considered as a predisposing cause of contraction of the back muscles and relaxation of the abdominal muscles is that the erector spinae are numerous and short, attached to a bony framework, while the abdominals are long, with a bony framework, and bear the strain of the weight of the abdominal viscera. Many other causes, some remote, predispose to faulty posture but we shall not attempt to enumerate them here because the mechanical problems which develop over a period of time are practically the same in various cases regardless of the cause.

Symmetrical Imbalance and Its Relation to Low Back Pains

When the imbalance is symmetrical there is mainly an involvement of antero-posterior muscles and the strain is felt in muscles concerned with antero-posterior movement. In the standing position, strain of maintaining antero-posterior balance should be divided evenly between the anterior and posterior muscle groups. When, for example, the abdominals have become weakened, the opposing back muscles are overtaxed, and in early stages, become fatigued. Later, as the muscles tighten, there is constant aching due to muscle spasm, which is relieved only by relaxation of the muscles. In the early stages the ache will be relieved by rest in the lying position, but later, after the muscles have become contracted, they will not relax merely by recumbency but require more vigorous therapeutic measures.

Asymmetrical Imbalance and Its Relation to Sciatic Symptoms

When the imbalance is asymmetrical there is an involvement of the lateral and torsion as well as antero-posterior muscles. When muscle imbalance is symmetrical in the legs and hips, neither leg will show extreme rotation or lateral deviation; however, when it is asymmetrical with pronation, internal rotation, or adduction more marked on one side than on the other, the position of the legs may become extreme in rotary and lateral, as well as antero-posterior, deviation.

In an article describing the relationship of the sciatic nerve to the piriformis muscle,[1] the possibility of sciatic pains being due to pressure of the piriformis over the sciatic nerve is offered as a theory. The following explanation of muscle imbalances in faulty standing position attempts to show how the external rotators of the hip, especially the piriformis, are placed in a position of tension to exert pressure on the sciatic nerve. Examination and treatment based on this theory have borne out the possibility of this pressure on the nerve.

In my experience most cases with chronic sciatic symptoms show pronation of both feet, same internal rotation of the femora, and a change in the abduction-adduction alignment but with internal rotation and pronation more marked on one side than on the other. The majority show the marked pronation, internal rotation, and adduction all on the same side. Occasionally an individual has pronation more marked on the side of the abducted leg but it seems relatively uncommon. The sciatic symptoms seem to appear consistently on the side of the adducted and internally rotated leg. (This does not coincide with the appearance of the patient with acute sciatic symptoms because the patient seeks relief in the acute stage by abduction, external rotation, and flexion of the affected leg.) In examination, the patients have all exhibited a marked weakness of the gluteus medius on the affected side. A test for leg abductors will not necessarily demonstrate the strength of the medius, therefore a test to isolate this muscle is of extreme importance and is described under "Examination f."

In the normal individual when one foot pronates, that leg internally rotates. The rotation can take place by rotation of the femur in the acetabulum or by a twist of the pelvis with rotation from the dorso-lumbar region of the trunk. If the external rotators of the hip are strong, their tension will resist marked internal rotation of the femur in the acetabulum, and the pelvis will rotate forward with the rotation of the leg on the side of the pronated foot. When, for instance, the left foot pronates drawing the pelvis forward on that side, it causes a slight drop of the left pelvis. This drop gives slight abduction to the left leg with adduction to the right. Over a period of time the forward twist of the left pelvis causes actual internal rotation of the right femur in the acetabulum because the pelvis is rotated in a clockwise manner. In this position of adduction and internal rotation of the right leg, strain is thrown on the medial side of the right foot so that a secondary pronation results which is frequently more marked than the original pronation on the left. However, if the individual stands with a marked anterior tilt of the pelvis so that the external rotators of the hip are weak and the muscles of the low back are contracted, then marked rotation will take place at the hip joint because the tight back resists the twist of the pelvis while the weak external rotators of the hip favor internal rotation of the femur in the acetabulum. In such cases adduction and internal rotation occur directly on the side of the pronated foot. In time, the position of adduction and internal rotation of a leg weakens and stretches the external rotators on that side, placing them on a tension. Due to their anatomical relationship to the sciatic nerve these taut muscles are in a position to exert marked pressure on the nerve. In many patients sciatic symptoms have completely disappeared by relieving the strain of the abductors and the external rotators of the hip.

Although the actual length of the legs is the same, the effect of a difference in length is obtained by abduction and adduction. In standing, when the body weight is shifted laterally so that one leg becomes adducted in the acetabulum, the pelvis is raised on the side of the adducted leg, giving to the pelvis and spine the same effect as a slightly longer leg. In treatment, therefore, to relieve the strain on the abductors and the external rotators on the adducted-internally rotated side, the other side is mechanically thrown into adduction by a straight raise on the shoe. On the side of the pronated foot and internally rotated femur, an inner border raise (as described below under "Mechanical Supports") will relieve the strain on the external rotators by correction of

the pronation of the foot. Exercises are directed toward developing the weak muscles in the legs and trunk and correcting faulty standing position.

SACRO-ILIAC STRAIN SECONDARY TO CONTRACTED LOW BACK MUSCLES

Examination and treatment of many patients suffering from low back pains and sacro-iliac strains have firmly convinced me that many of the sacro-iliac strains are secondary to a tight lumbar or lumbo-sacral region. In some patients the tightness is associated with apparent flat backs, and in others, with marked lordosis. In either type the lumbar spine is held rigid by the contracted muscles and is inflexible. The lumbar spine in a normal individual is flexible, and in bending forward to lift a weight, the strain is distributed evenly throughout the back. In a patient with tight low back muscles, freedom of motion is limited to the hip joint and upper back; consequently, in forward bending, a great amount of strain is thrown on the sacro-iliac region, frequently causing a stretch of the ligaments and muscles, with subsequent sacro-iliac symptoms.

SLIPPING OF THE FIFTH LUMBAR VERTEBRA

We have examined many patients with varying degrees of lordosis and anterior pelvic tilt in whom a diagnosis of congenital forward displacement of the fifth lumbar vertebra had been made. The examinations have led me to believe that the condition is not of a congenital nature but is acquired as a result of faulty posture maintained over a long period of time. My opinion is confirmed by roentgenographic findings.

Fig. 2, taken with a patient in a lateral lying position, shows the normal alignment of the lumbo sacral region. Fig. 3, taken of the same patient in a lateral standing position, exhibits a forward slipping of the fifth lumbar vertebra on the sacrum. The deformity which is obvious in the upright weight-bearing position is corrected in the recumbent position, and one would conclude that the patient has a flexible lumbo-sacral region which allows for the correction in lying. Over a period of time with loss of flexibility and development of contractures in the low back muscles, the deformity will remain fixed in both positions.

HAMSTRING MUSCLES IN RELATION TO LOW BACK CONDITIONS

The hamstring muscles have received much consideration in connection with low back and sciatic pains. In an acute sciatic irritation there exists definite hamstring spasm, but this condition should not be confused with the condition of the hamstrings in a chronic low back, sacro-iliac, or sciatic case. Tests done presumably to determine hamstring tightness have been very misleading. A normally flexible individual can perform a straight leg raise from the table to almost ninety degrees. However, if he hyperextends his lumbar spine in lying so that the pelvis is flexed on the thigh, the straight leg raise is limited to sixty or sixty-five degrees; then the tension on the posterior knees is so marked that the movement is painful. This tension is obviously due, not to the tightness in these muscles, but to the fact that they are being asked to stretch beyond normal. If this normal individual with his back hyperextended and the flexion of the leg limited to about sixty-five degrees allows his back to relax and flattens the lumbar spine on the table, that is, "rolls his pelvis," his legs will easily go to nearly right angles without pain. In the sitting position with legs extended forward, a normally flexible individual can bend forward to touch his toes without pain or sense of undue muscle stretching. A rigid back will limit the extent of forward flexion and will cause abnormal stress to be thrown on the hamstrings with pain to the posterior knees; again, due to the fact that the muscles are being stretched beyond normal. In most cases diagnosed as having tight hamstrings, an examination of the muscle power has revealed abnormal weakness which would not exist if the muscles were contracted.

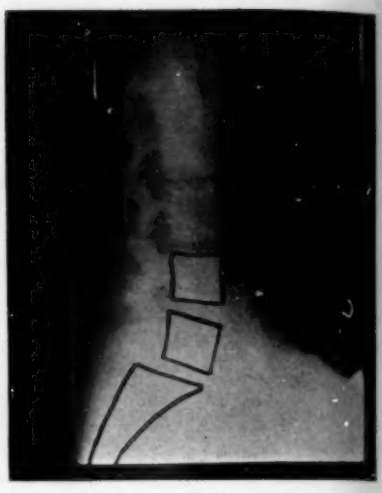

Fig. 2

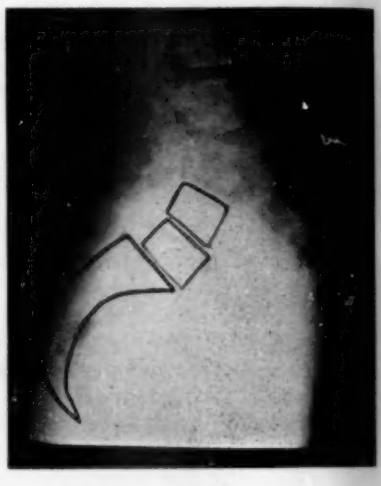

Fig. 3

In patients with marked imbalance of the trunk muscles, the anterior tilt of the pelvis is more pronounced in standing than in lying, and the tilted position, which raises the ischium posteriorly, separates the origin and insertion of the hamstrings sufficiently to cause constant tension to these muscles. Consequently there is a tenseness of the muscles, but it is due to stretching and not to contraction.

The relief that patients have received from straight leg manipulation has, I believe, been due to the mechanical pull on the back as the straight leg is flexed on the pelvis. Although the symptoms may be relieved for a time, I believe that the amount of damage done to the hamstrings, which are necessary in their downward pull on the ischium, is greater than the benefit to the back. It is possible to stretch tight back muscles without injuring the hamstrings. This is described in detail under "Treatment."

TENSOR FASCIA LATA CONTRACTION IN RELATION TO LOW BACK CONDITIONS

In a recent article on low back pains and sciatic symptoms,[2] the emphasis is placed on the contracted tensor fascia lata as the causative factor in these conditions. In most patients in whom the tensor fascia lata is a tight band anterior to the trochanter, it is true, as the article states, that there is usually associated a pronated foot, internally rotated femur, and anteriorly tilted pelvis (lordosis of back). When the origin and insertion of a muscle are held approximated over a period of time, either by mechanical means or functional position, the muscle will shorten and become contracted. Conse-

quently, the tensor, instead of causing any or all three of these conditions, is tight as a result of being placed in a position advantageous for the muscle to shorten because pronation of the foot, internal rotation of the femur, and anterior tilting of the pelvis hold the origin and insertion of the tensor fascia lata closer than a correctly balanced body. A tensor which has become contracted will then reinforce the already contracted back and internally rotated leg, and cutting or stretching it will undoubtedly relieve symptoms. However, since the tight tensor is a result rather than a cause, I doubt whether this treatment will give permanent relief unless supplemented by other forms of treatment. To permanently relieve symptoms of back strain it is absolutely necessary to establish a balanced musculature and normal flexibility of the trunk and to correct faulty foot and leg position.

Types of Painful Low Back

1. With lordosis
   a. *Functional*

The lumbar spine is flexible but the abdominal muscles are very weak, the femora are internally rotated, and the feet are pronated, allowing a marked anterior tilt of the pelvis. A patient of this type complains of chronic backache which becomes acute when he is fatigued but which is relieved in the lying position. The relief is due to the fact that the flexible lumbar spine will flatten in the recumbent position and the strain, which causes the pain while standing in lordotic position, is not present.

b. *Structural*

The lumbar spine has lost its normal flexibility and in both the standing and the recumbent positions it is held in a position of marked anterior bowing by the tight contracted erector spinae muscles. The abdominal muscles are weak, the femora are internally rotated, and the feet are pronated. These patients complain of constant pain which is not relieved in the lying position. The pain is frequently more severe after resting or on arising in the morning. This type may easily result in sacro-iliac strain due to loss of lumbar flexibility as described above under "Sacro-iliac Secondary to Lumbo-Sacral." Roentgenograms of these patients often show structural changes in the articular facets of the fourth and fifth lumbar vertebrae diagnosed as arthritic changes.

These changes are due to the fact that weight bearing is constantly thrown posteriorly and strain on the articular facets is greater than normal causing evidence of traumatic arthritis.

2. With flat back

In my experience I have not come in contact with a patient having a normally flexible so-called flat back with a balance between the strength of the back and abdominal muscles who has complained of chronic low back pains. The patient with a painful flat back is one with a rigid low back and is associated with acute sacro-iliac strains rather than with chronic lumbo-sacral pains. The weight-bearing line of the body is nearly normal in these patients and they do not exhibit the type of chronic low back pains associated with extreme faulty posture. This type seems to be most common in men who do heavy lifting.

Outline of Examination

Examination here does not refer to the general medical or complete orthopedic examination but to muscle testing and examination of posture. Cases referred for this check-up have previously had complete examination to eliminate causes other than faulty posture in relation to the low back pain.

1. Examination of standing posture
   a. Lateral view
   b. Posterior view
   c. Anterior view
2. Tests for flexibility and contractures
   a. Low back and hamstrings
   b. Hip flexors
   c. Tensor fascia lata
3. Muscle tests
   a. Anterior abdominals
   b. Posterior trunk
   c. Hamstrings
   d. External rotators of the hip
   e. Abductors of the hip
   f. Gluteus medius

Procedure of Examination

Examination of standing posture

a. Lateral view. Observe antero-posterior curves of the spine as compared with the normal. Observe the apparent tilt of the pelvis, contour of the anterior chest and the abdominal wall, and the position of the knees.

b. Posterior view. Observe any lateral deviation of the spine: rotation of the pelvis, clockwise or counter-clockwise; the relative height of the posterior spines; adduction and abduction of the legs. Particularly note the posterior view in sciatic cases. Palpate for tenseness and tenderness in the erector spinae and the other low back muscles.

c. Anterior view. Examination of the feet: Check for pronation by placing a ruler perpendicular to the floor against the outer border of the foot, noting the distance between the ruler and the outer malleolus. Position of the femora: Check on the rotation of the femora. (Internal rotation of the femur noted by position of the patella medial to the middle of the leg.)

Tests for flexibility and contractures

a. Low back and hamstrings

Standing. Patient bends forward to touch the floor. Normal: Patient is able to bend forward and touch the finger tips to the floor with well-rounded contour of the back and no strain to the posterior leg muscles or the back. Observe whether the patient bends directly forward with a well-rounded contour, or moves backward at the hips and bends forward with the low back held rigid. The backward movement at the hips is associated with, and indicates, a rigid low back because increased flexion of the hip is an attempt to compensate for the lack of flexibility of the back. In this motion the increased hip joint movement tilts the ischium up and increases the distance between the origin and the insertion of the hamstrings, placing an excessive tension on these muscles. Consequently, pain and stretching to the posterior knee must not be diagnosed as tight hamstrings—the muscles are merely being stretched beyond their normal length.

Sitting. A somewhat more accurate check on the flexibility of the back can be made in sitting than in standing because some of the strain of forward bending in standing is due to maintaining balance and this is relieved in sitting. Observe the relaxed posture of the patient sitting with legs extended forward on the table.

Normal contour: Convex backward in the dorso-lumbar region; and the patient may or may not come to right angle position depending on the freedom of the hip

joint movement and the degree of relaxation of the hamstrings.

Rigid lordotic back: The trunk can be raised only to an angle of seventy or eighty degrees with the table if the knees are held extended. The pelvis in this position however is actually flexed to almost ninety degrees on the thigh. In bending forward to touch the toes, the normal person will flex the spine and show a well-rounded contour of the entire back, while the individual with a tight back will flex the pelvis on the thigh—without flexing the lower part of the spine—and consequently the hamstrings will feel the stretch as in the "Standing forward bend," because of the excessive tension and the added strain thrown on them.

b. Hip flexors

Contraction of the hip flexors may be determined by the Thomas test: In the supine position with one thigh flexed on the chest, lumbar spine flat on the table, the other extremity will remain extended on the table if the hip flexors on that side are not contracted.

c. Tensor fascia lata

Patient side-lying on the table with the body in a straight line: The examiner carries the uppermost extremity with the knee extended, posterior to the midline, externally rotates it slightly and allows it to drop in adduction. If the tensor is tight the extremity will remain in abduction. (If the slight external rotation is not maintained a tight tensor cannot be demonstrated, because if allowed to internally rotate the tension is sufficiently released to permit the legs to drop in adduction.)

Muscle Tests

a. Anterior abdominals: Patient supine on the table: (Observe the amount of space between the lumbar spine and the table, showing to some extent the degree of pelvic tilt.) With knees flexed fifteen or twenty degrees, have the patient flatten the lumbar spine on the table by pulling up and in with the abdominal muscles and down with the buttocks. An individual with normal abdominal strength can perform this movement easily while a patient with very weak abdominals cannot. (This movement is given more as a preliminary part of the next test to show the patient how to flatten the lumbar spine than as a test in itself. In order to demonstrate abdominal strength, the tension ot the contracted back and hip flexor muscles must be released by sufficient flexion of the knees to permit the pelvis to move freely by the pull of the abdominal muscles.

Lower rectus (all anterior abdominals aid in this exercise but it especially tests the lower rectus): In order for the hip flexor muscles to flex both legs on the pelvis, the pelvis must be firmly fixed on the trunk. In leg raising with extreme weakness of the abdominals, as the psoas muscle contracts, the pelvis is tilted anteriorly and locked in hyperextension on the trunk; with strong anterior abdominal muscles, the pelvis can be fixed on the trunk with the lumbar spine flat on the table. Leg raising in itself does not show abdominal strength if the position of the pelvis on the trunk is not considered. The work of the abdominals is to fix the pelvis on the trunk, preventing hyperextension of the lumbar spine—the leg raising merely increases the difficulty by the added weight of the legs pulling downward on the pelvis. Therefore, the following test must be done carefully to obtain an accurate check of the abdominal strength. Have the patient roll his pelvis to flatten the lumbar spine on the table. With his back held flat on the table, the patient is asked to raise both legs with the knees extended. An individual with normal anterior abdominals can accomplish this movement. In a patient with weak abdominals, the weak rectus and the anterior fibers of the weak external and internal obliques will not hold the pubis and sternum approximated to fix the pelvis in a position of flat lumbar spine. They will "let go" as soon as the weight of the legs is lifted from the table, and the body will be thrown in a position of anterior tilt of the pelvis and hyperextension of the lumbar spine—indicated by the back arching from the table. If allowed to continue lifting the legs, the patient can often completely raise them, but the movement is not accompiished by the aid of the abdominal muscles.

Upper Rectus: (again, all the abdominals are used but especially the upper rectus): Patient supine on the table supported at the ankles by the examiner. With hands clasped behind the table, the patient is asked to "fold" up to a sitting position; that is, he raises head, shoulders, and then chest, flexing the entire spine as he raises up. An individual with normal anterior abdominals can easily perform this movement while one with weak upper abdominals cannot come to a sitting position unless his back is allowed to arch.

The difference may be described as follows: An individual with normal anterior abdominals comes to a sitting position by flexing the entire spine, initiating the movement at the head, and the pelvis flexes on the thigh as a secondary movement. An individual with weak anterior abdominals initiates the movement with flexion of the pelvis on the thigh by contraction of the hip flexor and low back muscles. The trunk is then flexed on the thighs by the hip flexors and near the completion of the movement the head and shoulders are brought forward with a sudden pull to an erect position by the upper anterior abdominals. Frequently patients with very weak lower abdominals who cannot begin to raise the legs without arching the back can come to a sitting position easily because the upper abdominals and psoas muscles are strong. This type resembles Type c, Fig. 1, who stands in a position of lordosis with depressed chest. This type of individual who can do neither the leg raising nor trunk raising correctly for abdominals is one in whom both upper and lower anterior abdominals are stretched and weak, and resembles Type b, Fig. 1, who stands in a position of elevated chest and anteriorly titled pelvis.

b. Posterior trunk muscles:

Patient prone on the table with the hands clasped behind the head or behind the back, body supported at the ankles by the examiner: The patient is asked to raise the body up backwards, lifting the head, shoulders, and chest from the table. In an individual with normal strength this movement is easily accomplished and the position can be held against resistance. Except those patients with such acute pain in the low back that it prevented their attempting this movement of hyperextension, none that I have seen with low back symptoms and weak abdominals has exhibited any weakness of the low back muscles. Doing this test and comparing the results with those of the abdominal tests demonstrates very clearly to the patient (and examiner as well) the extent of imbalance between the back and abdominal muscles.

c. Hamstrings:

Patient prone on the table with hips and knees extended: Have the patient attempt to flex the knee against resistance. (Do not permit the patient to initiate knee flexion passively by flexing the hip, but keep the hip extended.) With normal strength the knee can be flexed against strong resistance. In almost every patient who has an increased anterior tilt of the pelvis the amount of

hamstring weakness is amazing. Accurate muscle examination in many patients with suspected hamstring contraction frequently reveal such marked weakness that very slight resistance at the ankle prevented flexion of the knee.

d. External rotators of the hip:

1. (To determine the power of the external rotators with the hip in extension.) Patient prone on the table with the knee flexed to right angles: Have the patient roll his thigh outward by pulling his lower leg in toward the opposite leg against resistance.

2. (To determine the power of the external rotators with the hip in flexion.) Patient sitting with the knees flexed, the legs over the side of the table and the buttocks held evenly on the table: Have the patient roll his thigh outward by bringing the foot in toward the midline and hold against resistance. (The lower leg describes a pendulum movement inward while the knee remains in a fixed position on the table.)

e. Abductors of the hip:

Patient side-lying on the table with the body in a straight line, and the examiner holding the pelvis to keep the lumbar spine straight and prevent flexion of the pelvis on the thigh: The patient is asked to abduct the leg directly in the midline and hold against resistance. Movement forward of the leg or tilting forward of the pelvis shows lack of fixation by the gluteus medius and accomplishment of the abduction movement by the tensor fascia lata.

f. Gluteus medius

Frequently the abductors appear very strong while the gluteus medius, if carefully isolated, will show definite weakness. Therefore a separate test for the medius is done as follows: (Same position as above) The examiner carries the leg in abduction, slight external rotation, and slightly posterior to the midline of the body, and asks the patient to hold the leg in that position against resistance.

Outline of Treatment

Treatment in General Consists of

1. Establishing balance in muscles that hold the pelvis level by:

a. Stretching the contracted muscles by the use of heat, massage, and manipulation to restore flexibility.

b. Strengthening the weak muscles by carefully localized exercises supplemented when necessary by proper mechanical support.

2. Correction of faulty position of feet and internal rotation of femora by exercise and alteration of shoes.

Method of Treatment

Heat and Massage

The patient lies prone on the table with the feet extending over the end of the table, and a rolled blanket under the ankles to relieve the tension on the posterior knees. A pillow is placed directly under the abdomen to flex the lumbar spine. (Care should be taken in placing the pillow or if it is too far down under the hips or too far up under the chest, it will hyperextend rather than flex the lumbar spine.) Infra-red or radiant heat of moderate degree is applied to the low back for fifteen to twenty-five minutes. The low back muscles are then massaged, beginning if necessary with light stroking but increasing, by the end of two or three treatments, to a heavy deep kneading to soften and stretch the tight lumbo-sacral muscles and fascia. Very little thumb friction is used because it frequently irritates and causes the muscles to tighten rather than to relax.

Exercises and Stretching

A carefully graduated system of exercises and stretching is used. Cases differ and exercises are modified accordingly. Heat and massage always precede stretching. Most of the following exercises are done four or five times during the first few treatments and are gradually increased in number to ten or twelve by the end of the eighth or tenth treatment.

Prone with a pillow under the abdomen: Have the patient roll his pelvis over the pillow pulling up anteriorly with the abdominals and down posteriorly with the hamstrings and the gluteals to flatten the lumbar spine and stretch the hip flexors and the back.

Sitting: The knees are allowed to flex slightly by placing a rolled blanket under them so that in forward-bending, the tension on the hamstrings is relieved. The patient then reaches down toward the toes, pulling up and in strongly with the abdominal muscles and down with the buttocks. The movement may be rather crudely described as making the effort to "sit on the end of the spine" as in a slumped position while, at the same time, reaching forward toward the toes. This movement, if properly done, localizes the stretching to the low back muscles without any stretching to the hamstrings. If the back is quite rigid, additional massage is given while the patient is bending forward.

Note:—If the patient has a flexible lumbar spine, some heat, massage, and forward bending are given merely to maintain the normal flexibility. Since the faulty posture in this type is due to relaxation of abdominal muscles and faulty foot and leg position rather than to contraction of the back, the treatment consists mainly of exercises to the weak muscles to establish normal balance.

Patient Supine on the Table

1. Have the patient roll his pelvis until his back is flat on the table by pulling up and in with the abdominal muscles and down with the buttocks. A patient with weak abdominals but with a flexible back will usually do the movement quite easily, but in a patient with very tight low back and hip flexor muscles, the movement of tilting the pelvis to flatten the lumbar spine is prevented by the tight muscles, and the feeling of "rolling the pelvis" cannot be obtained until the hips are slightly flexed. The tension of the low back and hip flexor muscles is relieved by placing a rolled blanket or pillow under the knees to permit hip and knee flexion. An assistant grasps the anterior iliac crests of the patient with his hands and aids the patient to rotate the pelvis upward and posteriorly. After a few treatments the patient should accomplish the movement of flattening the lumbar spine on the table without the necessity of flexing the hips.

2. With his hands clasped behind his head, the knees bent, and the feet flat on the table, have the patient roll his pelvis until his back is flat on the table and, holding his back flat, straighten his legs by sliding his heels along the table. In the early stages of performing the exercise, if the patient raises his feet even slightly from the table as he extends the legs, the weight is too great and will cause the pelvis to tilt forward. This exercise strengthens the abdominal muscles sufficiently to hold the pelvis fixed in flexion on the trunk and overcome the weight of the legs and the tension of the hip flexors which tend to pull downward and forward on the pelvis. If the low back and the hip flexor muscles are contracted, the patient will not be able to maintain the correction of the pelvis as the legs become extended. However, as

the abdominal and gluteal muscles increase in strength, they will be able to oppose and stretch the strong low back and hip flexor muscles.

3. Have the patient roll his pelvis until his back is flat on the table, and with his arms folded on his chest, raise his head and shoulders about eight inches from the table until the abdominal muscles are tight. (This exercise is omitted in patients in whom examination reveals that the upper abdominals are strong and a tendency toward kyphosis exists.)

Note:—Trunk raising to a sitting position and double leg raising movements are done only as tests at various intervals, not as routine exercises. As explained under examination of the anterior abdominal muscles, the ability to raise the legs is no indication of abdominal strength. Even when examination shows that the abdominals are strong enough to fix the pelvis on the trunk so that the lumbar spine is held flat as the legs are raised, this movement will increase the strength of the hip flexors as much as the abdominals. The following exercise requires strong use of the abdominal muscles eliminating the use of the hip flexors, and at the same time, stretches the low back muscles.

4. The patient lies supine with the thighs flexed on the chest and the legs flexed on the thighs. The arms are held at the sides and the hands are placed palm downward on the table to maintain balance during the exercise. From this position the patient attempts to raise his buttocks from the table, pulling his knees toward his chin. If the abdominal muscles are too weak to initiate this movement, the patient can assist himself in starting the exercise. His elbows are held close to his sides, his hands with palms upward are placed under the buttocks, and the hands lift the buttocks by flexion of the elbows.

Standing: Instead of performing separately foot, leg, and abdominal exercises, the patient is taught to combine these exercises in the standing position in order to give him the complete feeling of correct posture, and because the best correction of the pelvic tilt is made possible only with correction of the foot and leg position.

1. (Foot exercise preliminary to exercise 2.) With the feet straight ahead and the knees slightly flexed, the patient rolls his weight to the outer borders of his feet by pulling up under the arches, and rolls his legs outward until the knee-caps are in the midline of the leg by pinching the buttocks together.

2. The patient stands with his back to the wall, his hands clasped behind his head, his elbows touching the wall, and his feet about three inches from the wall. With the position of feet and legs corrected as in the above exercise, he rolls his pelvis to flatten the low back against the wall by pulling up and in with the abdominal muscles and down with the buttocks. The corrected position is held as he steps away from the wall. Later the exercise is done without the support of the wall, but doing the exercise, in the beginning, against the wall, aids the patient in maintaining his balance and gives him an objective measurement of how much he is able to flatten the lumbar spine. This position at the wall also prevents the backward movement of the upper trunk which so frequently occurs as the patient attempts correction. In severe cases the exercise may be made less difficult at the start by placing the feet farther from the wall, allowing the knees to flex more and keeping the arms down at the side.

3. The patient rolls his pelvis by pulling up and in with the abdominal muscles and down with the buttocks. He then bends forward trying to keep the pelvis tilted back for as long a time as possible to obtain flexion in the back and prevent stretching of the hamstrings. If the patient moves backward at the hips and leans forward with the low back held practically straight, the bend necessarily takes place at the hip joints. If the patient completes the movement and touches the floor, he does so at the expense of the hamstrings. To prevent his backward movement, the forward bending is often done with the patient standing with his back to the wall and his heels about four inches from the wall. This position prevents an abnormal amount of backward movement at the hip joints and gives the patient the correct idea of bending over to touch the floor. The reason for the backward movement at the hip joints is not the fact that he does not know how to bend forward properly but rather that he is attempting to compensate for a tight back. Consequently, putting him near the wall to prevent backward movement will not enable him to touch the floor but will merely localize the flexion to the back rather than to the hip joints.

In some patients the back is so tight that modifications of forward bending in sitting with legs extended on the table or in standing still do not localize the stretching to the low back without marked stretching to the hamstrings. In these cases the stretching may be done sitting in a chair but not without extreme care and supervision.

Exercise. The patient sits in a chair with his buttocks about an inch forward from the back of the chair and his feet flat on the floor. He pulls in with the lower abdominals to flatten the low back against the chair. Then with his hands grasping the seat of the chair and the low back held against the back of the chair, he flexes the spine, pulling forward with the upper abdominals and assisting with a slight arm pull. Flexion should occur in the back, not at the hips, and an attempt should be made to approximate the forehead and the mid-thighs. The arms merely assist and must not do forceful pulling in opposing the rigid back. This exercise should not be used in sciatic or sacro-iliac cases.

TYPICAL LIST OF EXERCISES

Name.....

Exercises.....(date).....

Lying on Face with pillow under abdomen

(Apply heat to low back for 15—20 minutes)

(Massage to tight low back muscles for about 15 minutes)

1. Roll pelvis over pillow by pulling up in front with abdominal muscles and down in back with the buttocks to flatten low back.

Sitting

2. With knees sightly bent, roll pelvis and reach forward to touch toes without rounding back.

Lying on Back

3. Roll pelvis until back is flat on table, by pulling up and in with abdominal muscles and down with buttocks.
4. With hands clasped behind head, knees bent and feet flat on table, roll pelvis until back is flat. Hold back flat on table and straighten legs by sliding heels along table.
5. Roll pelvis until back is flat on table. With arms folded on chest, raise head and shoulders 6 to 8 inches from table. (Do not come to sitting position.)

Standing

6. With toes straight ahead and knees slightly bent, roll weight to outer borders of feet by pulling up under the arches, and roll legs outward (until knee cap is in midline of leg) by pinching buttocks together.
7. Stand with back to wall, hands clasped behind head, elbows touching wall and feet about three inches from wall. With feet and legs corrected as in above exercise, roll pelvis to flatten low back against wall by pulling up and in with abdominal muscles and down with buttocks. Hold corrected position and step away from wall.

Mechanical Supports

Abdominal

The most successful support in aiding the weak abdominals and relieving the strain of weight on the low back seems to be a modified Goldthwaite brace. For women, it is incorporated in a corset. A regular front lace abdominal corset is used and the brace attached to it. For men, it may be worn without the corset or incorporated into a canvas corset. Two very rigid steel bars which extend from about an inch below the inferior angle of the scapulae to the sacrum are covered with leather and sewed to the back of the corset, one on either side of the midline and about three and one-half inches apart. Three straps riveted to the steel on each side extend around the body and pass through three slits on the antero-lateral sides of the corset and connect with buckles to an abdominal pad about six inches across and four and one-half inches long. The steel bars do not conform to the lordotic position but are practically straight and "bridge" the lordosis, permitting the abdominal pad to lift the abdomen backward and upward toward the steel bars. Figs. 4 and 5 show respectively back and front views of a typical corset.

Fig. 4

Foot

In correction of pronation by shoe correction, the flexibility or rigidity of the foot should be considered. In a very flexible foot the longitudinal arch disappears when the foot pronates because there is a collapse antero-posteriorly as well as laterally. In a rigid or contracted foot the arch may be very low or very high and the foot still be pronated.

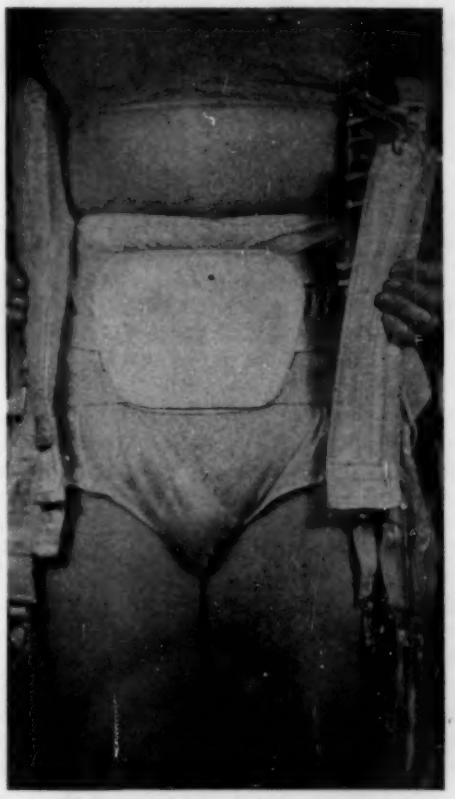

Fig. 5

In a flexible foot where pronation is not extreme, an inner border raise on the heel of one-sixteenth of an inch may be sufficient to roll the weight to the outer border. In more extreme pronation one-eighth or three-sixteenths of an inch may be required on the heel with one-sixteenth of an inch on the sole. With the inner border of the heel higher than the inner border of the sole, the longitudinal arch is assisted by rotation at the talo-navicular joint. In extreme pronation in the flexible foot, or the rigid foot with a low arch, more than an inner border raise is required. A combination leather and rubber arch support inside, or a hard rubber support on the outside under the medial side of the arch, is more beneficial, I believe, than a rigid steel plate. The steel plate does not permit normal action of the intrinsic muscles of the foot and they weaken after a period of time.

Pronation in a rigid foot with a high arch can generally be corrected by an inner border raise; and, since an increase in the arch by rotation of the talo-navicular joint is not desired, the raise on the heel and sole should be the same height. An inner border raise should not be placed on high heels with a very small base. If the patient wears cuban or military heels, the base should be as wide as possible. If the heel has a medium sized base, one-sixteenth of an inch elevation will be equal to one-eight or three-sixteenths of an inch on a broad flat heel.

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Trauma and "Invalid Reactions"

Herman Chor, M. D.

The role of trauma as an etiologic factor in many types of illness has received considerable attention and study. This is particularly true in affections of the nervous system. Various nervous disorders have been attributed, directly or indirectly, to trauma. Head injuries are frequently accompanied by involvement of the intracranial contents with damage to the brain, the meninges or cranial nerves. Subdural or subarachnoid hemorrhage may occur as a result of rupture of intracranial blood vessels. Occasionally fractures of the skull are accompanied by laceration of the brain with subsequent cerebral softening. Not infrequently injury to the scalp and skull permits the entrance of organisms and as a consequence meningitis or cerebral abscess may follow. Analogous lesions may be produced in the spinal cord as a result of injury to the vertebral column. Injury to the extremities commonly involves the peripheral nerves and gives rise to paralyses or sensory disturbances. These gross injuries are, as a rule, readily recognized and their management well defined. There are other types of injury syndromes, however, which are much more subtle and present interesting and difficult problems.

In the lay mind, fracture of the skull or spine, per se, is the chief problem associated with trauma. They frequently fail to recognize the essential fact that the real problem depends upon the extent of damage to the underlying nervous tissues rather than that occurring to the bony structures. Medical men who deal with such cases are well aware that it is not unusual to encounter head injuries in which the roentgen rays may reveal rather extensive fracture of the cranial vault and yet the patient may show no evidence of serious disability. Conversely negative roentgen findings may be obtained in cases of head injury in which severe involvement of the nervous system may be present. Careful neurologic examination, therefore, may establish the presence or absence of serious consequences of trauma.

Perhaps the most frequent syndrome resulting from injury to the head or spine is that generally referred to as "concussion." In these cases the nervous system has received a general "shaking up" or "commotio" rather than definite focal damage. A severe jolt to the head may or may not be associated with loss of consciousness. As a rule the duration of loss of consciousness indicates the seriousness of the injury. The "knockout" which occurs on the football field or in the boxing ring is a commonly observed example of "cerebral concussion." Sometimes the victim may recover very quickly and resume activity without suffering any noticeable effects from the blow. More frequently, however, the patient may complain of headache, dizziness, insomnia, weakness, or show irritability or unusual behavior reactions. In cases of "spinal concussion," weakness of the extremities and bladder or bowel disturbance may follow. These post-traumatic symptoms may occur very soon after the accident or may follow a latent period of days or weeks of apparently complete recovery. That such complaints may be the result of definite damage to the underlying nervous tissue has been demonstrated. Multiple punctate hemorrhages, injured ganglion cells, and meningeal adhesions have been found in clinical and experimental cases of concussion. To be sure, most cases of concussion do not fall into the hands of the pathologist. During the war, however, a sufficient number of cases were subject to careful analysis so as to establish the nature of this syndrome.

It is well recognized that trauma may be the precipitating factor bringing to light an underlying disease. Thus, cases of chronic alcoholism, syphilis and arteriosclerosis may show signs and symptoms following injury—signs and symptoms which the patient maintains occurred immediately following the accident and which he naturally assumes to have been caused by the injury. Occasionally a psychoses appears following an injury. Careful study will usually establish evidence of a preexisting neuropathic makeup activated perhaps by the occurrence of trauma. That the head injury caused the psychosis, however, is obviously a false conclusion. Of particular interest are cases of convulsions in which the history points to a head injury as occurring before the onset of the first seizure. To be sure traumatic epilepsy does occur. In such cases, however, there is usually definite evidence to establish a direct causal relationship. As a rule there is objective evidence of involvement of the intracranial contents as revealed by careful neurologic examination. Occasionally roentgen studies, including encephalography or ventriculography, may be required to demonstrate the lesion. In some cases the evidence may be even more subtle, and the occurrence of a focal type of aura may be the only grounds for contending that an organic lesion is present. In contrast to this group, however, are many others in which there is no proof whatsoever that the head injury had anything to do with the occurrence of spells. The trauma may well be considered an incidental experience in the life of an individual who in this instance happens to be the victim of idiopathic or essential epilepsy. At times head trauma has been associated with the onset of parkinsonism, choreiform disorders, and other nervous maladies. Here again it is difficult to ascribe to the trauma a direct causal role.

With these pictures in mind let us now consider those illness reactions which follow trauma, and designated "post-traumatic syndromes," in which there is no objective evidence of damage to the nervous system but in which the patient presents a number of complaints for which he requests, and indeed, demands treatment. As a rule an injury, just like an illness, has a fairly definite course. If the patient survives, a process of repair and recovery should ensue, the time required for such a recovery naturally depending upon the severity of the trauma and physical makeup of the patient. In case the reparative process is interfered with and recovery is delayed, a careful examination should ascertain this fact. In many instances of injury, however, even after a period of time deemed sufficient for repair and recovery the patient continues to complain of various symptoms

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and persists in demanding medical care. This is particularly true of those cases of trauma in which at no time was there any definite evidence of organic involvement. Surely the numerous bumps on the head experienced by children and the common occurrence of bodily injuries to adults in this day of fast moving automobiles and other traffic hazards are numerous and most frequently without disabling sequellae. Why then should there be such invalid reactions exhibited by this group now being discussed?

In a certain number of cases a ready answer is available. Whenever compensation is a factor it is not uncommon for the patient to "hold on" to his malady in order to receive "easy money." This type of reaction is obviously one of "malingering." Here the individual is masquerading under the guise of illness with a conscious goal in mind; namely, to obtain money. During the war certain individuals feigned illness or disability in order to escape undesirable duties or to avoid responsibilities. The term commonly used for this feigning was "gold-bricking." Military physicians soon developed many "tricks of the trade" whereby they could soon establish the truth or falsity of the "invalid's" complaints. Needless to say these "patients" were dealt with accordingly. In civil life the injured individual who cleverly feigns an illness reaction in attempting to obtain compensation is so undesirable a problem to deal with that insurance companies and industrial organizations are usually quite willing to make a prompt settlement and put an end to the matter. The only way to cure this patient is to pay him off.

The true "traumatic neuroses," however, presents quite a different problem. Here we are dealing with an individual who, following an injury of mild or severe nature, presents symptoms for which no objective evidence of organic disturbance can be revealed. In many instances the patient's complaints may be out of all proportions to the nature of the trauma. In other cases, an illness reaction may persist months and even years after the injury.

Following injury to the head the most common complaint is headache. This headache is as a rule vaguely described as a "dull ache" or a "heavy pressure" or a "tight band-like feeling." It is usually continuous. It is present in the morning when the patient awakens, persists during the day and accompanies him to bed in the evening. It has been present for days and weeks. Such a story is very unusual in cases of organic headache. As for associated phenomena, the above neurotic headache is rarely associated with vomiting or other definite symptoms commonly observed in cases of organic headache. There may be dizziness or "spots before the eyes." Headache, a subjective complaint, is at best difficult of evaluation. Fatigue is a common complaint. Lack of "pep," loss of ambition and falling off of interest may be presenting symptoms. Such complaints are typical of psycho-motor disorders, such as neurasthenia and anxiety neuroses. Insomnia, irritability, apprehension and difficulty of concentration are frequently complained of and cause the patient considerable anxiety because he fears that such symptoms indicate oncoming insanity.

In cases of spinal injury, pain in the back may linger on and on. Again the patient's description may reveal such vagueness and suggestibility as to arouse the examiner's suspicion of the presence of functional factors. The absence of objective findings such as altered reflexes or definite sensory disturbance serve to eliminate the likelihood of involvement of the spinal cord or its nerves. Bladder disturbances are rarely encountered although it is not uncommon for neurotic patients to complain of constipation or diarrhea.

Injury to extremities may have caused temporary motor or sensory changes. Very often the patient persists in nursing along an extremity, claiming motor disability or pain or numbness. Electrical examinations will soon establish whether or not an organic lesion is present. Normal responses to faradic current eliminates peripheral nerve involvement. Furthermore, the sensory disturbance complained of may not follow any true pattern of sensory distribution and thus establish its functional character.

In addition to the evidence presented by the character of the complaints an important aid in diagnosis is the recognition of those features in the patient so classically characteristic of the "neurotic personality." The experienced physician can in many instances "size up" his patient very quickly. The neurotic individual is super-sensitive, introspective, obviously emotionally unstable, intensely pre-occupied with himself, easily suggestible and shows the persistence of infantile trends. In this type of individual the occurrence of trauma usually calls forth an emotional response of fear. Although trauma itself does not evoke hysterical phenomena, when accompanied by fright, the stage is set for the production of a neurosis. The trauma has served to bring to the surface an expression of a preexisting emotional and psychologic conflict world in which the individual has been struggling. For these victims of "neurotic personality" live an existence fraught with frustrations and failures. It is not the purpose of this presentation to elaborate on the various theories of the etiology of the neuroses. It may be said, however, that there is a group of individuals who are unable to make adequate adjustments to reality situations. As a consequence they carry within themselves a maelstrom of emotional conflicts and psychologic reactions which plagues them throughout an unhappy existence. Their inability to obtain happiness and contentment, a goal which even the most wholesome of individuals find difficult to achieve, keeps them in a state of suffering. That this suffering is essentially of an emotional or psychologic content, however, is usually not appreciated by these individuals. Suffering, on the other hand, can readily be translated into symbolic bodily pain or physical discomfort. The neurotic individual is very willing and indeed pleased to attribute to "illness" an explanation for his unhappiness and failure. Thus it is that the occurrence of a bodily injury with its associated symptoms may be so readily taken up by the neurotic. For here is a way out; he can now explain his suffering—as of physical discomfort—without admitting the underlying unpleasant truths of his own inadequacy and failure.

With this concept in mind a logical explanation may be available for the motive behind the preference of certain injured individuals to accept a small compensation, refusing to relinquish their "illness reaction," rather than return to work and earn a salary even greater than the disability income. In such cases careful study would no doubt reveal emotional conflicts and psychologic situations to account for the individual's choice.

It should be emphasized here, however, that in contrast to the conscious, purposeful behavior of the "malingerer," that of the "neurotic" is essentially unconscious, although it too is purposeful. In the first instance, the goal is money or freedom from undesired duties or responsibilities. The goal for the neurotic is-

his survival. In the midst of his emotional distress and impending failure, the neurotic's subconscious asserts itself by usurping its host. The trauma has served to release this process. Thus we see a mechanism quite similar to that of "hysteria," which prompts some to term these traumatic neuroses "traumatic hysteria."

The problem of "illness reaction" to injury obviously demands careful study. There are on record many instances of trauma in which definite organic damage has been improperly evaluated in the light of outspoken emotional and functional features which led to improper management. Similarly, many individuals who have experienced trauma have been the victims of prolonged and elaborate medical and even surgical treatment whereas the real problem was a psychologic one, requiring careful psychotherapy.

The problems of diagnosis in cases of trauma are often very difficult. Subjective complaints are, to be sure, not easy to evaluate. Even if the evidence strongly supports a diagnosis of "neuroses," the possibility of injury to nervous tissues always remains in the background. There are many instances in which the keenest and most experienced of physicians find it difficult to decide whether or not the patient's "illness" is due to direct effect of trauma or to indirect "functional" reactions. Those who are engaged in the treatment of such cases should keep in mind the nature of these various types of "illness reactions" and thus be able to administer a plan of therapy appropriate to the true problem.

A Shorter Method to Record Progress of Spastic Cases

Jacob Sirkin, M.D., and Lois A. Whitfield[1]

In the treatment of spastic cases it is most essential to have adequate records in order to have a complete story concerning the progress of each patient. Due to the fact that treatment of these cases covers a prolonged period of time, i. e., several years, it is quite difficult to show in a clear concise manner, the progress made by the patient, in ordinary detailed reports which are made at intervals.

Most records in this type of case consist of either written notes, which of necessity must be detailed and

1. Chief Physical Therapist, Newark State School, Newark, New York.

NEWARK STATE SCHOOL, NEWARK, NEW YORK
Department of Physical Therapy

NAME D[redacted], John ADMITTED April 1, 1933

FIRST EXAMINATION: Aug. 1, 1933 EXAMINER: Dr. Severance

		Aug.'34	Oct.'35	June '36	
AGE 3 yrs. 9 mos.	I. Q. 29	SUBSEQUENT I. Q. 41	64	...67.	.....

HISTORY OF BIRTH AND INFANCY: Apparently normal delivery. Mother had severe uterine hemorrhage during pregnancy. Patient cried a great deal. Crawled at 1 yr.

DIAGNOSIS: Considerable spasticity and apparent athetosis.

TREATMENT RECOMMENDED:

MUSCLE RELAXATION ✓
MUSCLE TRAINING ✓
MUSCLE STRETCHING
OPERATIVE

DURATION OF TREATMENT: Approximately 2 - 5 yrs.

PROGNOSIS: Possibility of nearly complete recovery.

Fig. 1

CAPABILITIES	Aug. 1, 1933	Jul. 17, 1934	Nov. 24, 1934	Apr. 9, 1935	Jun 1, 1936
Lies quietly			+	+	+
Disturbed by extraneous noises	+	+			
Purposeful movements	+	+	+	+	+
Rolls over alone		+	+	+	+
Sits in chair alone	+	+	+	+	+
Sits on stool with pelvic fixation			+		
Sits on stool alone				+	+
Balances self with assistance	+	+			
Balances self standing alone			+		
Walks assisted	+	+	+		
Walks in walker		+	+		
Walks alone				+	+
Drools	+				
Speech - none	+				
Speech - monosyllables		+			
Speech - single words			+		
Speech - sentences				+	+
Speech plain					
Speech - gutteral		+	+	+	+
Dresses self with assistance		+	+		
Dresses self alone				+	+
Feeds self with assistance	+				
Feeds self alone		+	+	+	+
Continent		+	+	+	+
Grasping left hand - supination	Partial	Partial	+	+	+
Grasping left hand - pronation	+	+	+	+	+
Grasping right hand - supination	Partial	Partial	+	+	+
Grasping right hand - pronation	+	+	+	+	+
Straight leg raising - left	25°	90°	90°	90°	90°
Straight leg raising - right	25°	70°	90°	90°	90°
Overflow	4+	3+	2+	2+	2+

Fig. 2. Blank space indicates negative capability, "+" sign indicates positive capability. When patient advances from "walks assisted" to "walks alone," the former is left blank. Other improvements are treated in the same way.

lengthy, or motion pictures taken at intervals, usually six months apart. We still make use of both of these types but have felt the need for a short concise summary which could be used conveniently without pouring over lengthy records or showing moving pictures.

It seems to us that records which can be visualized at a glance by the examiner are advisable, in order that clarity as well as brevity may be incorporated in them.

In order to do this, we devised, at the suggestion of Dr. R. D. Severance, who is Consulting Orthopedist at the Newark State School, a card system which we feel might be of interest and help to others working in this field. As figures 1 and 2 show, not a great deal has to be written, yet the progress of a patient over a period of years may be noted at a glance. Also we have the history of the patient summarized along with diagnosis, treatment recommended, and the prognosis at the time of the first examination.

Another advantage of the card is that the physician, when making his periodic examination, is able to have before him the items which should be mentioned in his report. Occasionally when the physician checks on his records of previous examinations, he is unable to find mention of a detail which he had not intended to omit. The card system thus is an aid both to physician and technician in the recording of progress notes.

We realize that in other places a modification of the card system might be advisable, but it is offered as a basis upon which to work, or it may be used as it is, since we have found it satisfactory for our needs.

Utilization of Swimming Technics in a Corrective Program

Edith Lindsay

The term "swimming technics" refers to various forms of graduated exercises adapted for use in the swimming pool. Some of these exercises are built up to the various swimming strokes, particularly those of value in developing muscles weakened by lack of daily use. The combination of exercises and swimming strokes is therefore included in the term "swimming technics" which is more inclusive than "corrective swimming."

In the past and in many places at present, corrective physical education has depended on routine exercises and gymnastics as a means of preventing and correcting poor posture. Now we feel that there are additional ways of stimulating interest and in acquiring knowledge of one's self from the standpoint of health and physical efficiency. These include swimming and dancing as methods of posture correction to be used in conjunction with the present program.

The use of exercises in the pool for correcting deviations from the normal came to the attention of school departments only after we saw the development of the body with under-water exercises in those affected by poliomyelitis, fractures, etc. The majority of students in our corrective departments have minor deviations, in contrast to the more seriously affected individuals who require physical therapy. If these latter could so benefit by exercise in water, what might swimming do for a larger number having only minor deviations? This is a challenge to the physical educator. We reach a large number of young people who need help either in developing normally or in overcoming physical or psychological handicaps.

Physically subnormal individuals lack development and coordination, and have depleted nervous and physical energy. They acquire inferiority feelings which affect their social responses and their personality development. Conditioning is necessary to develop their muscle, neuromuscular skill, and tone of vital organs. If the general tone of the body is improved, the mental attitude will also improve. Mental hygiene is closely related to physical hygiene thus they must be taught together. This can be accomplished by teaching these students some motor skill along with postural exercises. Body control in activity contributes to feelings of success and security. Therefore I am advocating the use of swimming technics to develop skills and play that will carry over into life.

Dr. Carrell in his book "Man, the Unknown" stresses this point by showing the necessity of seeing the individual as a whole, drawing attention to the need of a better knowledge of man. He says it is impossible to bring up individuals wholesale—that we must recognize individual differences. In our corrective program with smaller classes and with our attention directed to individual needs, we can do much for each individual by helping him to develop and educate his physical self.

Swimming as an adjunct to our corrective program has been used for four years and with definite benefits. It is not a remedy for all deviations but it should, where possible, be offered in lieu of some other corrective measures for certain individuals.

Swimming tops the list of activities as to value in physical, social, psychological, and recreational development. Dr. Williams of Columbia says that swimming represents the ideal physical activity. The body is continually in a good extended position, allowing no opportunity for a slump. Prolonged standing and sitting produce fatigue, an important factor in postural defects. In the water, however, the weight of the body is supported in the horizontal position, thus removing strains and stresses from muscles, ligaments, tendons, and organs. The specific gravity of water and of protoplasm is practically the same; therefore no undue strain is placed on cell wall tissue. The whole musculature is involved in swimming, with particular utilization of the large skeletal muscles. In addition to the direct effect on the muscles, swimming is a superior activity in strengthening the vital functions and organic vigor of the body. The massaging action of the abdominal muscles needed to keep the internal organs in a state of tonus is provided by the leg thrash, which is controlled by muscles originating on the pelvis. Circulation is quickened. The heart, more nearly on a level with all parts of the body, easily compensates to the extra energy demands. The depth and rate of respiration are accelerated as muscular contractions demand an increased supply of oxygen. Continued exercise in the pool makes for depth and fine breathing adjustments. Assimilation and elimination are taking place faster than usual. Thus muscular exercise can be made organic exercise.

As a recreation, interest in swimming is increasing for it is a pleasant means of activity and one in which the majority can indulge during their leisure time. The student does not realize he is doing a series of exercises for posture improvement and development of muscle tone. This pleasurable mental state increases tone in muscles. There is definite relaxation during the recovery stage which is very important for a large number of our corrective cases. Relaxation is more complete in the recumbent position than in the sitting or standing positions as body tension is at a minimum. A hygienic environment with sunshine and fresh air is most beneficial and aids recovery.

Hawaii gives us many examples of well developed poised physiques derived from swimming and its environment. It is remarkable to see even small children of every race with well built strong bodies, a delight to the eye. Their feet show strength and good arches, a result of gripping sand. The contrast to our children

Read at the annual meeting of the American Physiotherapy Association, Los Angeles, California, June 30, 1936.

Assistant Professor of Physical Education, Mills College, California.

with their poor posture and muscle tone was immediately obvious.

The following conditions may greatly benefit by the use of swimming technics. First, fatigue posture with lack of muscular tone and firmness of tissues found in the normal individual. They do not possess enough strength and balance sense to maintain a corrected position. Round shoulders although part of fatigue posture are found very frequently in all age groups not presenting other symptoms. The scapulae are seldom adducted during our daily tasks or in any of our sports. Here again, exercises on the back, including back strokes, will be of value.

Second, malnutrition, including both over- and underweight individuals. It has been said that two-thirds of all school children suffer from malnutrition. Physical educators must do their share in combatting the harm from this source. The aim of physical education for the undernourished child is to increase organic vigor and vitality in addition to developing muscle tone. Exercise for this underweight group must be light, slow, rhythmical and not cause fatigue. The body must be maintained in a good position to allow vital organs to work efficiently. The underweight student with poor body mechanics can best begin correcting posture by increasing weight because exercise demands an increased supply of nourishment.

The overweight individual also needs attention. Owing to strains placed on internal organs resulting from increase in weight, exercise must prevent overtaxing the system. This can be accomplished by exercise in lying positions, and best of all by the use of swimming technics, permitting maximum function of large muscle groups without danger of strain. To increase oxidation, exercise of many muscles, especially large ones, is most effective. Diet plus exercise is advised for this group.

Third, scoliosis could be treated profitably by swimming technics through strokes to develop back muscles. Thus far we have used only preventive measures for those with scoliosis.

Fourth, the nervous child who has uncontrolled inefficient movements and poor coordination. Inefficient muscle action points to a faulty nervous mechanism. The indication is to reduce energy loss from postural strain. By developing poise and control of movement, this individual may learn relaxation. In time he develops a smooth rhythmical balance between tension and relaxation in movement. A definite aid to swimming technics for this type is the addition of music, resulting in less effort and more relaxation. A happy frame of mind increases the value of the exercise. This nervous, shy person learns an activity in which he can participate with others. He has feelings of inferiority because of his inability to indulge in sports, for almost all of the sports in high school have been too strenuous. Preventive needs are uppermost for this person.

Fifth, weakness of the abdominal and trunk muscles which is due to a great extent by the habitually poor sitting positions resulting in stretching of abdominal muscles. True floating positions are excellent for the development of trunk and abdominal muscles. Muscular development plays a large part in acquiring and assuming proper balance. Exercises must be given to the large muscle groups not used sufficiently in daily living. It is more important to tone up muscles of the abdomen and back than other parts of the body.

We have not as yet checked statistics as to whether development of tone in the trunk muscles by use of swimming technics has helped constipation and dysmenorrhea. The main causes of dysmenorrhea, according to several authorities, are poor posture, constipation, weak abdominal muscles, and fatigue. Therefore improvement of these by any method should aid in the correction of constipation and dysmenorrhea.

As to results, eighty-eight percent of the twenty-five students completing seven weeks in a swimming technics class show improvement in posture grade. The first posture grades were 7—B minus, 17—C, 1—D. The final posture grades showed: 15—B, and 10—C. Six of these students were restricted from regular activity because of an underweight condition. All of these gained weight and were put in the regular physical education classes.

This Spring an interesting experiment was undertaken, by permission of the college physician, with a group of ten underweight students. They had been on rest or restricted activity and had shown no change in weight. All of them wanted activity and needed it to improve their mental attitude. The experiment was explained to each as she was invited to join the class. Knowing the values of rest for the underweight, two-thirds of the period was spent resting in the sunshine and fresh air on pleasant days, and indoors on dismal days. Fifteen minutes was then devoted to light activity in the pool. After several lessons, music was added. The result was pronounced, showing in an immediate slowing down and control of movement with definite relaxation. Statement of students was that fatigue was lessened and that the activity was very pleasant. Discussion of food, rest, and budgeting time was also included. Everyone gained some weight; one as much as ten pounds. One student remarked that the class would be perfect if food could be served. This class proved its worth, if for no other reason than that the mental attitude of the students toward physical education went up by leaps and bounds. They emphatically requested that this class become a definite part of our program.

In another swimming technics class, we had a group of students overweight twenty-two to thirty-six pounds. In contrast to the above group, strenuous exercises were given. In the beginning fifteen to twenty minutes caused fatigue, particularly of the thigh muscles. As muscle tone developed, the time in the pool was increased. Again results were satisfactory. They were just as enthusiastic as the underweight group. Several other students have inquired about this class for the Fall term. Body measurements were taken at the start and again at the finish of the seven week period. The girl losing most consistently showed the following losses: weight, six pounds; bust, one and one-half inches; waist, one-half inch; point at anterior superior spines, one-half inch; hips, one and three-quarter inches; and thighs, one inch.

The exercises we use include many used in your hydrogymnasiums in addition to others gained from personal experimentation. Back strokes, flutter kick, and breast stroke are the ones most commonly used. Beginning exercises are done holding the side of the pool, on the face, the sides and the back. Free floating positions are used for advanced exercises. Finally simple combinations of exercises are combined into the complex swimming strokes.

Each year students are most enthusiastic about the class. Their opinion is that they secure much help in this pleasurable means of activity. It is something they want and can do as the work is graded to each indi-

vidual's needs. They lose themselves in the pleasure of the activity and forget that the aim of the class is development of muscle tone for posture correction or general body development. The experiment this Spring with the underweight and overweight has been very helpful and encouraging in the use of swimming technic classes for an increasing variety of corrective conditions.

Medical care, diet, and rest, aided by adequate training in physical education, are the best means of developing the body and treating cases that deviate from the normal. Poor body mechanics can be corrected only when the individual's strength is sufficient to maintain the erect position. A very important point to remember when giving exercise to develop the body is to observe emotional and mental reaction to the activities. By removing mechanical strain from muscles and ligaments and attempting to reestablish the tonus of muscle balance, we hope to keep the body in its best functioning position. This is one reason we expect results in posture correction to come from one of the most interesting and beneficial forms of exercise, that of swimming or the use of swimming technics in corrective departments.

Survey of Foot Conditions—Kindergarten Through Tenth Grade—Pasadena City Schools, October 1935

Claire Colestock

The purpose of the survey of foot conditions was to improve health service to children by obtaining specific information on foot conditions, types of shoes worn by school children, sizes of shoes and stockings, and habits in walking. The survey was under the direction of the Child Welfare Department and the Department of Physical Education. The committee working on the survey included Dr. Wm. Arthur Clark, Dr. Roscoe H. Brown, Dr. Gertrude Seabolt, examining physicians; and C. H. Peterson, Child Welfare; R. Dickinson, representing shoe manufacturers; and C. F. Martin and Claire Colestock, Department of Physical Education.

The study was carried on at the Longfellow Elementary and the Marshall Junior High schools. The examination was not required of all the children. The following note on a printed form was sent to the parents:

PASADENA CITY SCHOOLS

Department of Child Welfare

Name .....

In order to improve the health service of children in the Pasadena City Schools, a survey will be made of foot conditions of children during October and November, 1935. The study will be made under the direction of the Child Welfare and Physical Education Departments.

This study will necessitate checking the foot conditions of several thousand girls and boys. Will you cooperate in this study by giving your permission for foot examination of your child? It will be necessary for child to take off shoes and stockings. We shall appreciate your cooperation in returning this blank immediately.

Director, Child Welfare Department.

I grant permission for foot examination.

Parent's Signature .....

Mr. H. Lyon, Principal of Longfellow School, and Dr. E. S. Holbeck, Principal of Marshall Junior High School, were interested in the survey and assisted in every way in securing the cooperation of parents, teachers, and students.

Also the parents in both schools were very much interested. There were seventeen hundred and fifty examinations made.

In establishing a procedure for the examinations, Dr. Wm. Clark, orthopedic consultant for Pasadena City Schools, worked with the school physicians during the examination of several groups. Normal feet were designated by the doctors as those having no deviation. The following defects were checked: longitudinal arch, beginning or advanced; anterior arch, beginning or advanced; ankle pronation, beginning or advanced; corns, bunions, and other abnormalities. They also checked for correct foot posture; i. e., walk toeing forward; or incorrect foot posture; i. e., toeing out or toeing in.

Mr. Dickinson checked on the sizes of shoes and stockings that were worn—measured the foot to determine the size of shoe that should be worn, and checked on the type of shoe. He also made a print of the feet with the "Foot-o-Print" or "Pedograph" machine. As it is a well known fact that foot prints are not reliable in indicating arch conditions, the foot prints were not used in recording the results of the examination. However, the students were very much interested in the foot impressions. Especially in the cases of third degree flat feet, the foot prints were convincing and proved helpful from the point of view of instruction in comparing a foot with a good arch with the flat foot.

In summarizing the results of the examination, it was not possible because of the tremendous amount of detail to list beginning and advanced ankle pronation, beginning and advanced flat feet, and beginning and advanced effects of the anterior arch in separate groups.

If the doctor checked one of the items as advanced, that condition is recorded as an advanced condition. If there are no "advanced" checked, that condition is placed in the beginning group.

"Beginning" conditions may be a beginning ankle pronation, beginning longitudinal arch, and beginning anterior arch, or it may indicate only one or two of these conditions. Similarly, "advanced" may mean advanced

Assistant Director of Physical Education, Pasadena City Schools.
Read at the annual meeting of the American Physiotherapy Association, Los Angeles, California, June 30, 1936.

ankle pronation, advanced longitudinal arch, and advanced anterior arch, or it may indicate only one or two of these conditions.

Results—Foot Conditions (Grades Kindergarten, Three, Six, Ten)

In order to show that foot defects occur rather generally through the kindergarten to the tenth grade, the first table shows beginning and advanced conditions, boys and girls, in the Kindergarten, Third, Sixth, and Tenth Grades:

Kdgn.		Normal	Beg.	Adv.	Total Defects	Total Examined
Girls	No.	7	13	8	21	28
	%	25	47	28	75	..
Boys	No.	13	6	11	17	30
	%	43	20	37	57	..
3rd Grade						
Girls	No.	8	14	17	31	39
	%	23	35	42	77	..
Boys	No.	4	9	12	21	25
	%	16	36	48	84	..
6th Grade						
Girls	No.	17	18	10	28	45
	%	39	40	21	61	..
Boys	No.	12	17	5	22	34
	%	35	50	15	65	..
10th Grade						
Girls	No.	52	73	48	121	173
	%	30	42	28	70	..
Boys	No.	38	45	48	93	131
	%	29	34	37	71	..

In glancing at the percentages for both beginning and advanced defects, one sees that in the kindergarten, the percentage is 75 percent girls, 57 percent boys; third grade—77 percent girls, 85 percent boys; sixth grade—61 percent girls, 65 percent boys; tenth grade—70 percent girls, 71 percent boys.

Some Outstanding Points in Foot Conditions (All Grades)

Elementary

Girls		Boys	
Normal	26%	Normal	28%
Beginning	46%	Beginning	39%
Advanced	28%	Advanced	33%
Total, Beg. & Adv.	74%	Total, Beg. & Adv.	72%

Junior High

Girls		Boys	
Normal	31%	Normal	24%
Beginning	39%	Beginning	33%
Advanced	30%	Advanced	43%
Total, Beg. & Adv.	69%	Total, Beg. & Adv.	76%

In glancing at the percentages for Elementary and Junior High students, we come up to 31 percent normal only in junior high girls—other groups range from 24 percent to 28 percent.

Types of Shoes

In checking the types of shoe, a good shoe was checked on the following: Lace oxford; broad toe; low, broad heel; and a straight last. A composition or rubber sole was accepted in this group, although in our physical education classes we recommend a leather sole and heel with rubber cap.

A summary of the types of shoes worn by the students indicates that more elementary boys than girls wear a good type of shoe. Popular opinion would have it that boys and men generally wear a better type of shoe than girls. However, in the junior high school, grades 7, 8, 9, 10, a larger number of girls wear a better type of shoe than boys. Many boys had pointed toes, poorly made shoes, and of course many wore tennis shoes. We asked the boys if pointed toed shoes were the style at this time. The boys said that they were not in style. At least if they were the boys would not admit it! We concluded the boys got the kind of shoes they were offered and the kind which they could afford.

The results of the summary as to types of shoe show:

Elementary	Girls	Boys	Junior High	Girls	Boys
Good Type	62%	72%	Good Type	71%	60%
Poor Type	38%	28%	Poor Type	29%	40%

Sizes of Shoes

The check on the sizes of shoes proved to be enlightening. The shoes that are checked as too short range from one to three sizes off. However, the majority of the short shoes were one or two sizes too short. The records for the younger children, who are growing rapidly, indicate a very high percentage of shoes too short.

Elementary	Girls	Boys	Junior High	Girls	Boys
Short	82%	80%	Short	63%	74%
Long	1%	1%	Long	7%	9%
O. K.	17%	19%	O. K.	30%	17%

Size of Hose

The check on the stockings shows that many children wear short stockings also. The largest number of children wearing short stockings is also in the elementary school.

Result of summary as to stockings show:

Elementary Stockings	Girls	Boys	Junior High Stockings	Girls	Boys
Short	38%	40%	Short	20%	23%
Long	0%	1%	Long	0%	0%
O. K.	62%	57%	O. K.	80%	72%
No stockings	0%	2%	No stockings	0%	5%

Students Who Toe Forward in Walking

The summary shows that the majority of boys and girls "toe forward" in walking; i. e., they walk correctly.

Elementary	Girls	Boys	Junior High	Girls	Boys
Toe forward	79%	78%	Toe forward	82%	69%
Toe in	2%	1%	Toe in	1%	0%
Toe out	19%	21%	Toe out	17%	31%

Miscellaneous

Miscellaneous items checked by the doctors were very small in the elementary school. Incorrect shoes, short shoes, and stockings and other causes, over the longer period of years, probably contribute to the larger number of abnormalities checked in the junior high school group.

Total Elementary Examined—495

Miscellaneous items:

Poliomyelitis, left leg (kindergarten)	1
Pain bottom of foot (4th grade)	1
Web toes (3rd grade)	1
Corns	11

Total Junior High Girls—692

Miscellaneous items:

Everted toes	10
Enlarged joints	3
Heels calloused	47
Callouses on both feet	4
Ingrowing toe nail	1
Deformed little toes	9
Callous on ankle	1
Club foot operated	1
Small toes amputated	1
Pronounced inflamed joints	1
Small 4th toe on R	1

(Corns were checked frequently)

Total Junior High Boys—554

Miscellaneous items:

Deformed little toe	1
Poliomyelitis	1
Web toes	1
Wart on sole of foot	1
Infected toe	1
Enlarged joint	1
Papilloma	1

(Corns were checked frequently)

NOTE: Because of the danger of spreading the infection, students who had any symptoms of athlete's foot were not permitted to take the examination. An inspection for athlete's foot had been taken in September. Students who had any symptoms of the infection were given special instructions on hygiene of the foot. Each student was given a portion of a mixture of sodium hypochlorite crystals and boracic acid recommended by the school physician. (Boracic acid powder 80 percent, sodium hypo-sulphite 20 percent, crystals powdered and mixed with boracic acid.) The use of the powder and better hygiene of the feet cleared up the infection in many cases.

SOME EFFORTS TO IMPROVE FOOT CONDITIONS

Now that the facts of the conditions of feet of school children are before us, what can be done about it?

The results indicate that more and better instruction on the hygiene and care of the feet is urgently needed. More effort should be made to eliminate the causes of poor feet. Efforts were made in these two schools and in all of the schools to stimulate the work for better foot hygiene. Many of the students examined in the survey were of course in the corrective classes, and when it was possible to arrange their programs, other students were transferred to these corrective groups. In the elementary school, several conference periods were scheduled for parents who were interested in knowing the results of the survey as it applied to their children. Forty parents in the Longfellow School came for information and advice and were interested in making an effort to follow-up according to the needs of their children. In the junior high schools the physical education teachers held both group and individual conferences with students. Instruction on foot hygiene and foot exercises were given to all students.

PRINTED BULLETINS ON RESULTS OF SURVEY

A bulletin was prepared with results on the survey and some general instructions for better hygiene of the feet. The material in this bulletin was discussed in physical education classes in all schools and a copy of it was given to the students to take home for the parents' information and guidance.

Ten thousand bulletins were printed and distributed to students and parents. The small printed folders covered the following points:

BETTER SHOES
Survey of Foot Conditions
1750 Feet Examined
BETTER FEET
Foot Needs Indicated
Grades—Kindergarten Through 10th
BETTER POSTURE
Information for
Parents—Teachers—Students

SURVEY SHOWS:

FEET—
27% Good
40% Beginning Poor
33% Advanced Poor

SHOES—
67% Good Type
33% Poor Type
21% Length O.K.
75% Too Short
4% Too Long

WALK CORRECTLY—
78% Toe Forward in Walking
22% Toe Out in Walking

SUPERIOR HEALTH ATTAINED THROUGH
GOOD FEET
CORRECT WALKING
GOOD POSTURE

HYGIENE OF THE FOOT

A GOOD FOOT—
1. Good longitudinal and anterior arch.
2. A straight line on the inner border of the foot, from the heel to the end of the big toe.
3. Muscles of foot and leg—Good muscle tone.
4. No sagging-in of ankle bones.
5. Free from callouses and corns.
6. Straight tendon Achillis.

SOME CAUSES OF POOR FEET—
1. Malnutrition.
2. Glandular disturbance.
3. Illness.
4. Incorrect shoes.
5. Shoes too short.
6. Stockings too short.
7. Running barefoot on cement sidewalks and streets.
8. Wearing tennis shoes all day.
9. Incorrect walking.

SOME FOOT EXERCISES—
1. For beginning foot conditions, exercises, as walking—toeing forward, with weight on outer border of feet, picking up marbles with toes, and walking pigeon toed, are generally recommended.
2. If there is pain in feet, or if there are foot defects, consult an expert.

A FEW POINTS ON CORRECT SHOES

A GOOD SHOE FOR SCHOOL—
1. Leather Sole and Heel (heel with rubber cap).
2. A Straight Last—The line on the inner border of the shoe from the heel to toe should be a straight line.
3. A Lace Oxford fitting well over the instep.
4. A Low Broad Heel.
5. A Broad Toe.
6. Shoe should be sufficiently long.

POINTS IN FITTING SHOES—
1. Proper support for longitudinal arch.
2. Broad toes—Freedom for toes.
3. Ample length in shoes.
4. Accurate width for anterior arch—not too much spread.
5. A shoe that permits weight bearing on proper base: Heel, the big toe region, and the heads of the metatarsal bones (the ball of the foot) and the junction of the fifth metatarsal and the cuboid (outer border of the foot).
6. The heel of the shoe should fit the heel of the foot snugly.
7. Central portion or waist of shoe should fit snugly.
8. Length size varies approximately 1/6 of an inch.
9. Width size varies approximately ⅓ of an inch.
10. In fitting, consider standing position of the foot to insure sufficient length.

SUGGESTIONS ABOUT SHOES AND FEET—
Walk, toeing forward—Best weight bearing.
Buy good shoes—Cost more—Last longer.
Don't wear shoes and stockings too short—Cause corns, callouses, bunions, ingrown toe nails—other serious foot defects.
Don't wear rubber and composition soled shoes all day—Make feet perspire, muscle sag—cause fatigue.
Don't wear pointed toed shoes—Cramp feet—Cause corns, callouses, bunions, overriding toes, etc.

HYGIENE OF FOOT—OUTLINE FOR TEACHERS

An outline on the foot was sent to the teachers for use in their discussion in physical education classes. The following points were covered in the outline:

1. Position of Feet in Correct Standing Position: Feet forward (feet parallel, one to two inches apart).

2. Correct Standing Position:

In a standing or walking position—in simple terms, the erect individual with head held high, *feet parallel* and the segments of the body balanced vertically one upon the other so that the normal physiological curves of the spine are maintained, has good posture.

3. Weight Bearing—Standing and Walking Position:

In standing and walking, the weight should be borne on a three point triangle: the heel, the heads of the metatarsals, and the junction of the cuboid and the fifth metatarsal (the outer border of the foot).

In faulty standing and walking, when individuals toe out, the weight has to be carried more on the inner border of the foot which interferes with and prevents the normal development of the arch. To correct the habit that is prevalent among children and adults "of toeing out" and allowing the ankle to sag in making the arch bear the weight, it is said that the weight should be borne *on the outer border of the foot* in contra-distinction to the inner border. It is in reality borne in three points, as above stated: the heel, the heads of the metatarsals and the junction of cuboid and fifth metatarsal.

4. Demonstrate and Explain:

a. Longitudinal and anterior arch—get a foot skeleton and point out the arches on the skeleton and the bones that make up the arches (Science Department for foot skeleton).

5. Demonstrate a good longitudinal and anterior arch (using student).

6. Points in a good foot:

a. A *good* longitudinal arch. (May be a high arch or a low arch, varies in individuals.)

b. A good anterior arch.

c. A straight line on the inner border of the foot from the heel to the end of the big toe.

d. Approximately the heel should be about one inch narrower than the toes.

e. The muscles of the foot and leg should have good muscle tone, (should not be soft and flabby). They should show considerable grasping and prehensile strength.

f. Should be free from callouses and corns.

g. Should be no sagging-in of ankle bones on the inner side of the foot—from "Corrective Physical Education for Groups" by Lowman, Colestock, and Cooper[1] —"Place a flat surface against the foot from the floor up to and under the internal ankle bone—It should touch the whole inner margin of the foot."

h. Straight tendon—Achilles.

i. Gravity line of foot and leg—See L. C. C. Corrective P. E. for Groups, page 32.

7. Signs of Beginning Weak and Flat Feet:

a. Standing and walking position "toeing out."

b. A flat longitudinal arch (the weight carried on the inner border of the foot).

c. Flat anterior arch.

d. Enlargement at big toe joint—deviation of big toe (no straight line on inner border of the foot).

e. A great difference between the width of the heel and the width of the toes. Front of foot unusually broad in relation to heel.

f. Flabby soft muscles. Poor muscle tone of the muscles of the foot and leg.

g. Callouses and corns.

h. Spurs or extra bony growths on foot.

i. Unusual bulging of the ankle bones on the inner side of the foot.

j. Curved tendon noticeable in rear of heel.

k. Additional symptoms that may or may not be present: pain in feet and legs; swelling in feet; enlarged ankles; tendency of ankles to turn; enlarged joints; contracted toes; bunions.

8. Demonstrate—Flat Foot and Pronated Ankle:

(If student demonstrates—be careful not to choose a sensitive boy or girl. Have a student demonstrate from the point of view of showing how well he can correct the incorrect foot position.)

9. Demonstrate—Flexion and Extension of Foot; Inversion and Eversion of Foot.

10. Exercises for Feet. See Corrective P. E. for Groups, page 393.

11. Discuss Causes of Poor Feet.

12. Discuss—Effect of High Heels; Effect of Shoes with Pointed Toes; Value of Good Feet; Effect of Poor Feet.

13. A Recommended Shoe for School has the following characteristics: (See outline above.)

14. Discuss with the Student the Condition of His Feet (use record).

a. (One period should be spent in general discussion and demonstration; several periods should be given over to individual conferences when the record of foot conditions, size of shoe, etc., may be discussed with the student.)

b. Have student bring street shoes to conference.

15. a. Discuss the shape of foot as compared to the shape of the shoe.

b. Stockings should be sufficiently long.

16. Reference for Material on Hygiene of the Foot:

a. Corrective P. E. for Groups—Lowman, Colestock, Cooper, page 69.[1]

b. Individual Gymnastics—Drew, page 204.[2]

c. Preventive and Remedial Physical Education—Stafford, page 159.[1]

Results—Reports by Teachers, June 1936

These reports are presented from the point of view of the interest of students and teachers, not from the point of view of improvement. It was not possible for the doctors to reexamine the feet.

Report from Mr. H. Turner—Marshall Junior High School:

A thorough foot examination was given to 554 boys. Forty-three percent had advanced foot defects. Of this number there were dropped those who graduated in February and those who left school since the date of examination. To this number were added those who had shoe difficulties only.

Two hundred and fifteen boys were checked. Foot conditions were gone over carefully with all classes and afterward with each boy individually.

Remedial exercises were given in classes and were given to boys according to their need. One hundred sixten boys reported that they had done some work at home; 24 boys reported some improvement; 8 reported much improvement; and 139 boys said their shoe difficulties had been corrected. Results of the examinations have been entered on their permanent record cards and will be used again.

Report by Mrs. Edna N. Tallon:

Fine results were made by the foot examinations. Records of students were checked with each individual. Foot hygiene—instruction in all classes. Foot exercises were given to all classes. Special exercises were given to individuals according to individual needs. Re-check on foot and shoe conditions showed a definite improvement. 154 girls bought larger shoes. 120 girls bought longer socks. 152 reported they were doing exercises at home. Records entered on permanent health record and will be used again.

Needs of School Children

The needs of school children as to foot conditions are obvious, even without a survey.

More corrective classes, more time on foot hygiene for all students, more emphasis on removing the causes of foot defects, better education of parents as to foot needs, education of retailers and manufacturers of shoes, better fitted shoes and stockings and good shoes for

physical education class work—all are of vital importance in any health program. Dr. C. L. Lowman in "Corrective Physical Education for Groups" by Lowman, Colestock, and Cooper[1] says, "The usual type of rubber soled tennis shoe or sneaker is decidedly unsatisfactory for general usage at home and for all phases of physical education (tennis excepted). It offers no support for weak feet and tends to injure the average foot. It is absurd to wear a tilted heel or correction for a short leg for other foot wear and then change to the usual type of gymnasium shoe without correction . . . ." Dr. Lowman recommends the use of an old pair of orthopedic or broad type low shoes, by removing the heel and sole and replacing them with a rubber or fibre heel and sole.

The need for a better shoe for physical education is also brought out by Leslie W. Irwin in the April number of the Journal of Health and Physical Education in the article on "Physical and Health Education Program in the University of Chicago Laboratory Schools." Mr. Irwin says, "In past years the physical examination records have revealed an increasing tendency toward pronated and weak feet among our pupils. In an effort to improve this condition the gymnasium shoes worn have been given careful consideration. Many of the gymnasium shoes on the market now evidently were made primarily with the idea of meeting competition. Apparently the building of a right type of shoe for the foot has been a secondary matter, due to the increased cost entailed. For that reason a careful examination of many gymnasium shoes was made by the consulting orthopedist and the physical education teachers. Not finding the exact type of shoe they desired, an effort was made to have them manufactured. This was unsuccessful as the Laboratory Schools could not guarantee the use of a large enough quantity and the cost of a few hundred pairs would have prohibited their sale. Finally, a medium weight shoe with a built up longitudinal arch was selected. Arrangements were made through the consulting orthopedist to have metatarsal arch pads inserted in the shoes at a small cost. This particular type of shoe is used largely for its protective features. It is felt that the one-hour daily physical education period and the after-school play program may be a contributing factor toward pronated feet, especially so if the feet are inadequately protected against the jumping, turning, twisting, and slapping on the hard surfaces of gymnasium floors which may tend to break the arches. The longitudinal and metatarsal arch pads with a medium weight shoe should offer protection during the physical education period."

BETTER EDUCATION OF SHOE RETAILERS AND MANUFACTURERS

The problem of getting a correct shoe is a difficult problem, not only for children but also for adults. Ruth Brindze, Chairman of the Consumer's Council, Westchester County, New York, in "How to Spend Money" published by Vanguard, 1935, brings out some pertinent points on shoes:

1. "To be a good buy, a shoe must not only be honestly built, it must also be honestly and expertly fitted.

2. "One foot specialist estimates that only one person out of five has feet that have not been deformed by ill-fitting shoes.

3. "In 1934 the copyright office listed 865 arch and health shoes registered by trade names. Such shoes should never be worn by people with weak or fallen arches.

4. "Quoting from American Medical Association: 'Since every foot differs from every other one, it should be at once apparent that no shoe constructed according to a standardized type could be quite adequate for any deformed or weakened foot.'

5. "Persons whose feet have been deformed or weakened should consult a foot specialist who will prescribe the shoes with the necessary corrective features."

The high percentage of foot defects in men and boys at the time of the world war influenced many state legislatures to pass compulsory physical education laws. It is an interesting commentary that a survey of children twenty years later discloses similar startling figures.

The physical education laws have not eliminated the defects but there is some hope for the future. There is a growing recognition of both the need and the problem on the part of doctors, parents, teachers, physical therapists, and social workers. Much helpful material is available for use of those who are interested in working on the problem. Dr. C. L. Lowman in "Corrective Physical Education for Groups," 1928, and in "Balance Skills," 1935,[2] gives practical suggestions for posture, feet, and the right kinds of shoes, and calls attention to the necessity for the care of the feet in early childhood. Dr. Sven Lokrantz emphasizes the same points in his very excellent bulletin on "Health Supervision of Kindergarten Children." Many bulletins with helpful suggestions for parents are issued free of charge by the Department of Public Health, State of California, and by the United States Department of Labor. "Good Posture for Babes and Runabouts," a bulletin published by the State Department, and "Good Posture in the Little Child," published by United States Department of Labor, give both foot and posture exercises for the very young child. Other helpful tendencies are the fact that school administrations permit time to be given for research and study on the problem which stimulates interest in the work. Clinics have been established where help may be secured by those who need help and cannot afford to pay for it.

Due to the depression, corrective classes have been eliminated entirely in many schools, especially in the elementary schools where the work is most effective since it is possible here to reach the younger children. However, some of the corrective work has been maintained in spite of the depression. The problem of foot defects is not one that will be solved in a short period of time.

The stimulation of interest in the problem; the general recognition of the need; the better education of teachers, parents, and social workers; more enlightenment on the part of shoe manufacturers and retailers; and continued concentrated efforts of all who have to do with health and physical education must of necessity improve the conditions and eliminate some of the foot deviations of the present day.

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1. Published by A. S. Barnes, New York City, N. Y.
2. Published by Lea and Febiger, New York City, N. Y.
3. Published by Edwards Brothers, Ann Arbor, Michigan.

Peripheral Vascular Diseases

V. W. Leonard, M.D.

It is generally accepted that the most important need in medicine today is a better understanding of the broad subject of vascular disease. A casual glance at mortality and morbidity statistics proves this. Progress thus far in the study of this vital group of diseases has scarcely advanced beyond the contributions of pathology. Etiological agents are virtually unknown. Early diagnosis is difficult at best and impossible in most instances. Treatment has suffered, as it generally does, from a lack of fundamental scientific knowledge. Nevertheless, the tremendous amount of thought brought to bear on the subject since the turn of the century has not been fruitless by any means. It can safely be said that greatest progress has been made in the treatment of vascular disease in its relation to the arteries of the extremities. The purpose of this paper is to discuss briefly certain aspects of this advance, keeping in mind always that the physician's primary aim is to restore circulation to the point where the patient is not only free of symptoms but also to a degree that will forego the necessity of radical surgical intervention.

Basically, the cause of all symptoms complained of by the patient with occlusive vascular disease, whether due to pure spasm or narrowing from pathological changes in the vessel wall encroaching upon the lumen, or both, is a blood supply inadequate for tissue demands. Most prominent among these symptoms of course is pain, appearing first usually as intermittent claudication and developing later into intractable pain at rest. In course of time there develops all too frequently indolent ulceration and frank gangrene.

Diagnosis in the majority of cases is not difficult because the majority suffer with occlusive vascular disease. The patient who presents himself with a painful extremity, other causes being ruled out, can be said to have vascular disease if there is inordinate paling on elevation, inordinate blueness on dependency and deficient pulsations in major vessels. Confirmation of the suspicion can be had by the finding of diminished oscillometric readings. When the pulsations in major arterial trunks are good and the oscillometric readings are satisfactory, the disturbance may be due either to arteriolar disease or to simple vasospasm. Certain refinements have been introduced to locate more accurately the seat of the trouble. Chief among these is the estimation of skin temperature by thermocouple and after vasodilatation, secured either by nerve block or just as satisfactorily and more conveniently by general body warming, or the appropriate warming of an extremity other than the one under investigation, all readings being taken in a constant temperature room. If, with the use of such methods, the temperature of the cold pathological extremity returns to a normal point, one can conclude that no real arterial occlusion exists and that the trouble is due to vascular spasm only. Fortunately for practical purposes it is not necessary to employ these refinements because, as stated before, the majority of patients present occlusions due mainly to arterial disease though spasm is practically always a contributory factor. Furthermore, the majority of patients whose difficulties are due to vascular spasm only, present clinical features of diagnostic value. Typical of this group is Raynaud's disease in its earlier phases. The distinction between vascular spasm and occlusive arterial disease is an important one, however, because therapeutic procedures designed only to release spasm cannot be expected to help materially the individual with more advanced obstruction because in such a case the degree of vasodilatation necessary to promote increased blood flow cannot possibly be secured.

It is not possible at this time to discuss at any length all the many contributions to treatment. It is important, however, to emphasize three basic considerations: (1) the ailing extremity must be studied in relation to the individual as a whole; (2) the unassailable criterion for immediate efficacy of any method is its capacity to cause increased flow of blood as measured by increased temperature of the extremity; and (3) the ultimate purpose of treatment is to restore collateral circulation to a degree that it can meet physiologic requirements. It might be said at this point that to date there is no one method that will prove worthy in all respects; hence the necessity for many modes of treatment. One finds that there is a good deal of provincialism in viewpoint, each clinic sponsoring its own methods. Thus Silbert of New York advocates hypertonic salt for Buerger's Disease; Bernheim of New York attributes great value to high calcium diets in Raynaud-like vascular spastic diseases; Herrmann and Reid of Cincinnati stress the efficacy of passive vascular exercise; and this listing might run on to considerable length. One finds complete agreement, however, on certain fundamentals of treatment. The extremity to which the circulation is deficient must be looked upon as the seat of a potential gangrene and for that reason meticulous care is taken with such matters as minor surgical procedures, maintenance of warmth both locally and generally, and complete abstinence from tobacco smoking which regularly causes a drop in skin temperature. It is agreed also that the active vascular exercises introduced by Buerger and modified by Allen are of great value. Diabetes if present should be brought under control. The general circulation should be improved whenever possible because inefficient heart action diminishes blood flow. A matter of elemental importance is the question of the proper resting position of the extremity. The blood should not be asked to flow uphill by insisting upon elevation of the extremity; rather, one should elevate the body to an angle of 15 to 20° with respect to the leg which is the position at which the available flow to the diseased leg as indicated by color is most often found to be maximal.

The most recent contribution to treatment PAVAEX (passive vascular exercise), is now well-known. Credit for its introduction must be divided between Herrmann and Reid of Cincinnati and Landis and Gibbon of Philadelphia whose original papers appeared in 1933. The least enthusiastic statement one can make is that in some cases, at least, the method unquestionably satisfies the

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criteria for efficacy mentioned before; namely, it increases skin temperature by increasing blood flow and it tends to encourage the development of collateral circulation. A word about fundamental principles is now in order. In occlusive vascular disease one is dealing with the flow of fluid through a rigid tube and it can be shown, in accordance with Poiseville's Laws, that the amount of blood flowing through such a tube is directly related to the fall in pressure along its course. Logically then it might be assumed that if one could artificially reduce venous pressure to a level considerably below atmospheric pressure, the passage of blood from the arterial to the venous side would be greatly encouraged. That the Pavaex or similar machines accomplish this can be conclusively demonstrated both by simple observation of color changes in the extremity and even more convincingly by noting by thermocouple the increases in skin temperature while the treatment is being given. Furthermore, such increases persist after one treatment for as long as 48 hours but slowly return to the original temperature by the end of another 24 hours. As long as treatments are given at intervals of no more than 48 hours the temperature will continue to remain above that originally recorded. Benefit is greatly enhanced, as would naturally be expected, by maintaining as great a degree of vasodilatation as is possible during treatment periods.

Thus far the method has been applied with the expected good results in obliterative arteriosclerotic disease, Buerger's Disease, Raynaud's Disease in certain stages, the threatened gangrene of frost bite, acute thrombotic or embolic arterial occlusion, acute arterial spasm incident to operative procedures on major arteries, certain indolent varicose ulcers, ununited fractures and certain cases of arthritis showing signs of impaired circulation. The contraindications are phlebitis and infection. One can best orient himself on the question of practical values by considering the attitude of those who have thus far accumulated the greatest experience with the method. Hermann and Reid who have treated the greatest number of cases are enthusiastic. Landis and Gibbon who have made the fundamental studies are mildly enthusiastic. Shipley of Baltimore seems to be quite enthusiastic. Allen and Brown of the Mayo Clinic, with far less clinical experience than that of Hermann and Reid, are willing to concede a place in therapeutics to Pavaex but are not convinced that results with it are superior to those obtained by other methods. Our most striking results have been the improvement of intermittent claudication, the relief of rest pain and the healing of long standing indolent ulcers.

In conclusion I might say that while Pavaex is certainly not a panacea, it is based on sound principles and constitutes a valuable addition to the therapy of vascular disease of the extremities.

A Program for Birth Injured Children

Elizabeth C. Addoms

At the Neurological Institute the following schedule of activities has been evolved for a selected group of children afflicted with severe motor disabilities resulting from birth injury:

1. Academic education

The New York City Board of Education maintains at the Institute a school for physically handicapped children. There is at the present time an enrollment of twenty pupils ranging in age from six to fifteen years. School hours are from nine in the morning until half past two in the afternoon. Lunch and rest periods are of course included in this time. In addition to the regular program of studies art and music appreciation classes are provided.

2. Group rhythms

Twice a week a qualified instructor conducts dramatic singing games which are aimed to benefit the youngsters physically and socially. Those who are unable to stand in the circle participate actively from their seats.

3. Corrective motor education

Each pupil receives a half hour or more of individual muscle training which is carried out by both formal routine and the play method. In particular cases water treatments are prescribed.

4. Occupational therapy

Once a week after school hours the group meets for craft work which is planned to aid in the reconstruction program of each child.

5. Free play

Permission is given the children to use the spacious lawn of the Institute for recreation from half past two until half past four daily. There is a maximum of supervision during this period. Play equipment is provided and the boys and girls conduct their own games.

A psychologically sound merit system for the recording of physical progress has been devised which has proved effective for three years. It consists primarily of a series of carefully graded objective tests for each pupil which is posted about one month after the opening of the school term. For the first three tests passed, blue stars are awarded and affixed to the youngster's test chart; for the next three, red stars are given. Six stars entitle the pupil to a place in the "Hall of Fame." This means that his snapshot is taken and placed on the bulletin board in the main hall where all who pass may see. For each additional test passed, a gold star is pasted on the margin of his picture; so that by the end of the school year an ambitious child might view his picture in a gold frame. The test charts are kept on file from year to year and constitute a detailed record of progress. Note that the "Hall of Fame" scheme offers no material reward and that recognition of accomplishment is the sole stimulus to further effort.

Supervisor, Department for Correction of Motor Disabilities, Neurological Institute of New York.

The Requirements of Specific Exercises

Ira G. Wilson

The problem of developing exercises for specific purposes is inherently different than the teaching of "general" exercise. In "general" exercise the emphasis is often placed upon "constitutional" improvement. Large muscle areas are sometimes stressed more than the small muscles. This approach may be, and usually is, inadequate for the rapid solution of a specific problem. The effort must be concentrated. Definite criteria of improvement should be set up. Quantitative measurements should be used wherever possible. These act as a constant challenge to more rapid and effective work since they demonstrate improvement or lack of it.

One of the present purposes is to analyze the fundamental requirements for exercise programs, lessons and exercises for specific problems and to state certain conclusions which result from the recognition of them.

The elemental units are the exercises. These should be designed so that they may be standardized yet sufficient flexibility must be left to cope with individual difficulties in learning them. The necessary requirements so that these objectives may be realized will be enumerated. A number of exercises are combined to form a treatment or lesson. This must be planned so that it is an effective unit in the procedure yet capable of modification to take care of conditions which vary from day to day. The organization of such lessons forms a second topic.

Finally, a program—a prearranged course of proceedings—integrates the series of lessons into a frontal attack. It is to be assumed that progress must be made —that improvement must occur. The program defines the steps along the course. Ideally, it should also afford a measure of the advance.

Due to the complex organization of the body and its involved coordinations, farsightedness is almost essential. For it frequently occurs in exercises that other muscles play as important a part as the contracting muscles. Before an exercise is attempted, its prerequisites should be known and mastered. The helping muscles should be ready to play their part. By looking ahead, proper preparations can be made for the smooth execution of the plan.

In coping with an individual problem, two primary requirements should be met: *efficacy* and *safety*. The requirements which the program, the lesson, and the exercise must meet in order that they be both effective and safe should therefore be examined.

For clarity in presenting the basic concepts, the order of consideration will be program, lesson, and finally exercises.

Requirements on the Program

Objective. The objective should be clearly defined. The most common objectives are:

1. Improved strength and tone of muscle groups
2. Improved body mechanics
3. Increased range of movement
4. Increased endurance

To these may be added:

5. Change in body proportions
6. Increased speed of movement and reaction to stimuli
7. Improved control (precision in movement) and coordination
8. Better balance
9. Development of skill

Selection of the Objective in an Individual Case. In a particular problem certain of these objectives will be emphasized more than others. The selection will not always be the most logical, for the individual may have preferences which tend to override technical considerations. In such cases, the instructor should attempt to shift the objective by education. In many cases several types of improvement are needed. To attempt to develop all simultaneously does not seem desirable. If it be tried, then the result is "general" exercise rather than "specific" exercise. Failure to reach any of the objectives may result. There must therefore be a selection of the one or, at most, two which are to be solved first. When these have been completed, others may be initiated and so on.

Concentration of Effort: Localization. This leads to the conclusion that attention should be concentrated on small groups of muscles or small body areas. Furthermore if effective work on too many areas is attempted in the same lesson, physiological limitations such as fatigue defeat the objective.

Since only one or two areas can be selected initially, due to the various possible combinations, programs will have to be developed for each person. Yet due to the localization, certain techniques will be found to be best in most cases. After considerable experience it is likely that partially standardized procedures can be designed. But flexibility must be provided to cope with special cases. One of the present objectives is to indicate the direction of development to attain such a measure of standardization as is attainable.

Measurement of Efficacy. A measure of the effectiveness of a program is the time which it takes to accomplish improvement. In this modern world emphasis is laid upon speed. This of course is advantageous from every aspect. Desire to attain more rapid results inspires a constant effort to improve every detail. This places great demands upon the competency of the personnel. But with improved techniques the staff and equipment can accomplish more.

Measurement of Progress. It is desirable, if not essential, that progress be demonstrable at the earliest possible moment after the beginning of the program and continuously thereafter. One of the most certain ways of accomplishing this is a series of quantitative measurements. It is far more satisfactory to know how much the dimensions or strength have improved than to depend

[1] Wanda Bowman and Ira G. Wilson, New York and Brooklyn, N. Y.

upon haphazard comparisons or qualitative statements.

To attain the full benefit of measurements it is desirable that the patient be instructed as to their meaning. Then he can concur in their validity.

Progression. The cornerstone upon which a program is based should be a graded series of exercises. Progression is essential for both physiological and psychological reasons. For, if an individual executes a particular exercise, he either retrogresses, stands still, or advances. Obviously if the first or second of these is true, the requirement of efficacy is not met.

If he does improve, the exercise may be made easier, remain unchanged or be increased in difficulty. The first of these alternatives is unthinkable. The second is sometimes followed. But the repetition of an exercise many, many times does not cause improvement commensurate with the time expended. Furthermore, if this were correct, then it follows that there is a "one best" exercise for a particular group of muscles, irrespective of any other factors which may be present. This is probably untrue. It seems essential to design the exercise so that definite physiological effects are evoked within a reasonably short time.

The conclusion is that graded exercises are necessary, in fact, essential. Our experience in Wilson-Bowman System shows that only in this way is rapid progress possible. This is substantiated by measurements on many cases. Psychologically, progression is valuable, for it furnishes a goal. By proper design a given exercise can be executed a particular number of times and then a step taken in advance. Such a procedure fosters confidence. The spirit of play may be utilized by designing the series of exercises so that the quite advanced steps lead to a stunt or semi-acrobatic feat. Obviously in many cases this may not be possible. But there is far more incentive in a substituted objective (such as a handstand), and mental satisfaction after it is accomplished, than in a monotonous waving of the arms in the air even though the two movements achieve the same result. An unimaginative routine of a few exercises endlessly repeated is a sure way to boredom. Yet the progression should not be so fast as to cause discouragement. In the ideal situation both pitfalls are avoided.

General Principles of Progressive Series of Exercises. The combination of the various objectives and the various body areas necessitates numerous graded series. For a series which will develop the strength of the thigh will not of necessity simultaneously increase the range and control. Obviously it might have negligible effect upon the flexors of the hand, and therefore each objective must be considered independently.

Requirements on the Steps of a Series. Excluding massage, electrical stimulators and mechanical devices, the types of specific exercise in order of difficulty are:

1. Passive Exercise
2. Assisted Exercise
3. Active Exercise, or a more difficult assisted exercise
4. After this state has been reached, successive steps may be either more difficult assisted exercises or more difficult active exercises, or an alternation of the two.

By the use of passive or assisted movements, the strength of the weakest invalid may be matched. And, by utilizing the body weight at a disadvantageous leverage, an exercise may be made so strenuous as to test a strong man. Thus the extremes of difficulty may be met.

To design the intermediate grades is a problem requiring a knowledge of pure mechanics, body mechanics, the muscular systems, and physiology. The present discussion mentions the design objective but will not concern itself with specific methods of meeting them. First of all, the discrete steps must be small so that the transitions from grade to grade are not too difficult. With excessively large steps, time is wasted in futile attempts to negotiate them. This is both inefficient and discouraging. Second, interlocking of series may be essential so that necessary strength, skill and range will be available for an advanced step. Of course such special requirements may sometimes be avoided by design of the series to reduce the number and types of prerequisites.

Safety. The program should be safe when the patient first embarks upon it and throughout the pursuit of it. It should be planned to comply with every requirement of the body from a safety angle. Strength, range or endurance should never be taxed to the utmost. Where there is a question of judgment, obviously it is better to err on the side of safety. Thus in using abdominal muscles, every case should initially be treated as an incipient hernia. Chances should never be taken.

This requirement may be met by the use of carefully graded series which have been properly matched to the individual's strength. Exercises which cause fear should be used with extreme care, for under these conditions safety may be greatly reduced due to unexpected reactions.

Other Requirements. An atmosphere of calmness and tranquility is essential for the best work. It is impossible to concentrate as well in a noisy environment as in a quiet, peaceful atmosphere. It seems that there should be intangible advantages in having the exercise room bright and sunny. In any case it may be made cheerful by the use of light and cheerful colors. An essential in any institution engaged in work for the improvement of health and physical condition is scrupulous cleanliness. This is necessary in exercise rooms, the showers, such relaxation facilities as may be supplied, and the storage facilities for suits or costumes. Fortunately this ideal can be achieved by conscientious work supplemented by careful supervision. Above all, the odors prevalent in many gymnasiums should be sedulously avoided. Stale perspiration and body odors are unpleasant to fastidious people.

It is desirable that the floor space be reduced to a minimum compatible with efficiency. This reduces a large item of overhead, namely, plant investment or rent. However, the space allotted cannot be too small or there will be a sense of confinement. An area 12 feet square is about the minimum for individual work. A space 14′ x 20′ can comfortably accommodate four people.

If apparatus is used it should be chosen for its value in achieving the desired improvement with safety. Certain very effective exercises are impossible without the use of bars or other simple devices. Obviously when no more simple means can be found of achieving the result, they should be used. However, as a subsidiary requirement, the psychological reaction cannot be neglected. For apparatus which requires a monotonous repetition of a single motion speedily loses interest and becomes distasteful.

The Adaptation of a General Program to an Individual Case. In designing a program for an individual case the patient must be inducted into the program at the precise point which his condition requires and carried forward day by day as fast as his progress warrants. The

methods which may be used to determine the introductory level are thus of considerable importance.

Physical Condition, Past History. The medical history obviously will affect the program. The importance of a physical examination by a physician and a knowledge of any movements or procedure contraindicated by his findings cannot be overstressed. The action of the muscles and the range of movement may be restricted by breaks, strains and displacements. Post-operative conditions will greatly modify the initial steps.

Physical Ability. Allowing for difference in strength and objectives, it seems that exercise is equally beneficial to either sex. Knowledge of physical ability and recent physical training may aid in planning a course of action. These should be determined by a questionnaire. All of this data should be supplemented by tests to determine the capability at the time. Measurements of the muscular strength and the range of important joints are indicated. Adequate standards should be available for comparison.

The Effects of Age. Age may affect the time necessary to accomplish a desired improvement. For after youth has passed, the older the body the less quickly it responds. Also in adults the daily occupation may have lengthened or weakened certain muscles or restricted the range of some joints. This may place special requirements upon the program and the exercises. Alternatively it may be necessary to develop these portions before the primary problem may be attacked. In older individuals the range of movement may be restricted due to lack of elasticity in opposing muscles or other reasons.

Psychological Factors.

Mental Attitude. The patient must desire help. Proper cooperation and perseverance in the execution of a program is almost essential. If it cannot be obtained, only mediocre results are usually possible. Lack of cooperation due to a misunderstanding of the requirements necessary to reach the objectives may seriously handicap progress. The degree of confidence of the patient in the instruction will vary. It is essential that this be increased, if it be initially low, as rapidly as possible. Much depends upon the instructor and his leadership.

Intelligence. Since a specific problem demands precise movements, higher intelligence is required in such cases than in "general" exercise. A variation in intelligence may necessitate a difference in the program and in the approach for different patients. For young children the play aspect must be stressed.

Psychological Type. In cases of inferiority complex, unusual means may be necessary. The presence of such quirks gives rise to problems in grouping individuals and in the admission of spectators to view the work.

Safety Precautions. There are two types of fear which may be encountered: timidity and actual fearfulness. When a patient is just starting it is natural that he should be timid and not sure of correct performance. In other cases due perhaps to an injury, certain positions are intolerable or call forth unusual reactions. Thus the person who has been injured in diving may have a fear of any position in which the head is lowered. The program of individual exercises must be designed to cope with this peculiarity.

Use of the Data. The information on the physical condition, taking all factors into account, determines the most strenuous exercise which may be given a pupil safely. This should be ascertained for each muscle group or area which will be used before embarking upon any course.

Psychological factors may modify the standard procedure. Substitute exercises may be necessary where the standard demands too much concentration. Also, upon occasion, due to personal idiosyncrasies, individuals dislike certain exercises. Whenever possible, alternates should be available.

The Number of Pupils in a Group. For economic reasons the problem of grouping pupils frequently arises. In some cases by teaching two or more whose physical abilities and ultimate objectives are closely alike advantages may ensue. In such a group it is frequently possible to use imitation, one of the most rapid methods of learning. By pointing out one of the group who is performing in a superior manner the others may be shown their defects. Also in this way the laggards are usually fired with ambition. However to achieve these results temperaments must not clash. Race, sex, age and intelligence and even such intangibles as difference in social position and manners must be considered. Such idiosyncrasies as vanity (desire to be seen only in attractive circumstances), a peculiar physical problem or an unpleasant personality may make individual instruction a prerequisite for optimum results.

Special problems arise where the pupil is an introvert. Even should it be desirable to group two or more such individuals they may object because of a desire not to appear inferior. Frequently however such a person needs the inspiration of competition, for when he realizes he is superior in some if not all of his physical attributes a portion of the complex is overcome. In some cases when a bad physical defect has been corrected the inferiority is eliminated in other fields also.

How large a group may work simultaneously depends to some extent upon the exercise being practiced and the previous training of the individual members. For careful work, the maximum that can be supervised closely seems to be four to six.

Requirements on the Individual Lesson

The lesson should be regarded as a unit in the general program.

Since the exercise must be localized it follows that only a limited number of areas must be stressed in the lesson. Such lesson units differ therefore from those of the Swedish system which proposes to exercise all of the important body segments in every lesson. For specific purposes such an allotment of time proves to be wasteful since segments which need relatively little attention divide the time with those needing much work. The major portion of the time allotment of the lesson should be concentrated upon the specific problem. It is desirable to show progress from lesson to lesson in order to maintain the interest in the work. With careful planning of the program and choice of the component exercises this should be possible.

Flexibility in the Daily Lesson. The daily lesson content must be planned in advance, to further the entire program. Yet the amount of exercise which can be given on a particular day depends upon the physical condition on that day. Sufficient latitude must be available in the lesson plan to take care of these variables. The instructor must recognize their presence and be competent to make adjustments in the quantity of exercise to compensate for them. The most important are:

Fatigue. The physical capability of the body varies due to such factors as sleep, food, work and hour of the day. Absence for a few lessons, illness or fatigue due to mental strain may also affect the condition.

Tension. In movements where the range of the body is determined by the tension of opposing muscles it

has been found that this tension will vary from day to day as a result of such fa tors as fatigue and mental strain.

Menstruation. Studies indicate that the physical efficiency of women is affected adversely during the menstrual period. Opinion is divided as to the advisability of exercise during this period.

Compensation for Daily Variations. Several methods of varying the amount of work are possible. The number of exercises in the lesson may be reduced. The step used in the progression may be reduced. The number of times the exercises are executed may be decreased. Which of these should be chosen will depend upon the circumstances. No general rule can be given but the importance of watching for the onset of fatigue cannot be overstressed.

Safety. It is desirable to exercise only so long as the body is not overtaxed. When the work is excessive the body gives unmistakable and unpleasant symptoms of fatigue. If this occurs it is well to stop and pursue the course another day. The work should be easy enough to insure recovery from fatigue within a short period of time. Undue stiffness or soreness should be avoided. It is our belief that excessive stiffness the next day indicates an overdosage of exercise. Comfort must be considered after as well as during the lesson. Ample facilities should be provided for rest and relaxation after the exercise to give the body a chance to recover. While in some cases it is necessary to give exercises of considerable severity, particularly when initiating a new routine, it is always possible to provide relaxation time for the return to normal. Exhilaration rather than exhaustion after the lesson should be the objective.

REQUIREMENTS ON THE INDIVIDUAL EXERCISES

Efficacy demands that the particular muscles which are weak must be improved. Safety demands that there be no undesirable reactions, such as overstrain of any part of the body, overdevelopment of any part, or disproportionate development. The objective should be adequate strength for the demands of everyday life plus a reasonable margin for unusual conditions.

Since the problem is localized, a specific exercise is usually necessary. To assure control over as many variables as possible the movements must be formal; the pattern must be precisely determined and defined as to starting position, course, speed and terminal position. Such standardization furthers the objective of planned programs. To carry it out, a definite performance should be set which when attained is the signal for progress to the next step in the series. By such planning, errors of judgment on the part of the instructor are reduced to a minimum.

The Necessity for Selection. It is possible to concoct an extremely large number of exercises. There are many movable articulations in the body. Many of these have several degrees of freedom; i.e., they permit polyaxial movements. Furthermore the extent of the movement is variable. Finally pure movements may be combined. It is not difficult to demonstrate by the theory of permutations that the number of possibilities is inconceivably large.

It is a fundamental principle therefore in the use of any exercises that selection is essential. Little can be claimed on the score of invention of new exercises. This however is not necessary. The problem is to choose those which perform the desired function in the optimum manner.

Types of Movements to be Avoided. In the usual case, the development of skill is not a primary objective. Furthermore many skills are not transferable. Repetition frequently improves only the particular movements which have been practiced. Therefore the requirement of efficacy rules out of consideration exercise which requires considerable mental effort to avoid mistakes.

Since the emphasis is upon precision, the attention should be concentrated upon the movement itself rather than upon a sequence of movements which may then be less perfectly executed. Such factors eliminate multicount exercises from consideration. This is particularly true of odd count (5-7-9 position) exercises. Clearly the execution of a long routine such as is required for a dance is not the function of specific exercises.

For similar reasons, complicated exercises in which the arms and legs are not coordinated, and dissymmetrical exercises, such as moving the right arm and left leg, should be avoided. Furthermore experimental psychology shows that the development of coordination and skill formerly claimed for them may be of little real value. Of course exhibition exercises, where show is the main object, have no place in such a program.

Simple Movements. Even the simplest body movement is seen to be quite complex upon careful analysis. Initially it is desirable, for the sake of simplicity, to design the movements to involve a small number of joints. Then in more advanced work the objective may be the coordinated and combined movement of several joints. Once the pattern is chosen the best method of approach is to perform that movement in a simple form, that is, using only a few positions (preferably two alternately).

In any specific exercise it is important, first, that the pupil understand exactly what he is asked to do and, second, that he be capable of directing his body to do what is required. As simple movements are easy to learn, a minimum of understanding, concentration, and coordination are required. The minimum age which can be benefited may thus be considerably reduced. To facilitate teaching, the exercise should be easily demonstrated and remembered.

For ease in determining the working muscles, the movements should be simple. At the present state of development of body mechanics and kinesiology, major difficulties are encountered in the study of complex movements. Yet ideally to maintain a sufficient control to enable the prediction of their effects, complete understanding is necessary. The demands are even greater when quantitative as well as qualitative control is the aim.

Alternating Movements. The alternate contraction and relaxation of the muscles is one form of exercise. It tends to avoid the cramps sometimes encountered in tetanic contractions. To maintain control of the movements a momentary halt is necessary between the opposite movements. In general the rhythm should not be of such a nature that it allows the momentum of the moving segment to do the work. Furthermore in a very fast tempo this halt gives the muscles a chance to adapt themselves to the next movement and tends to prevent antagonists from acting against each other. There are exceptions however. In certain cases momentum increases the range of movement as it augments the muscle force at the end of the range. It will be obvious however that such exercises must be used with great caution for reasons of safety as the segment is not under good control.

Speed of Movements. Movements may be made either slower than, at, or faster than the normal rhythm. Irregular rhythm may also be used. The elements of the body possess normal rhythms which are set, among other factors, by the mass and radius of gyration. Most efficient work is done when the speed corresponds with the natural rhythm. However it is by no means certain that the natural rhythm is the optimum speed where muscular development is the objective. For in this case the muscles should be worked hard to increase their strength. Either a slower, faster or irregular rhythm might be used. Certain factors tend to the choice of slow speed for most uses. In choosing the rhythm it is essential that the comfort of the pupil be considered. By jerky, uneven movements, or accentuated flinging motions, it is possible to upset the nervous system. On the other hand, slow, easy, rhythmical exercises tend to control random twitchings and uncontrolled movements. Uneven rhythm may have use in special cases such as group work where the instructor is gaining attention or where the instruction is "at will." Movements faster than the optimum rate are used to develop speed. It is important to make sure that the same exercise is being performed when working at higher speeds. Much of the difficulty and benefit may be inadvertently lost if inhibiting muscles do not perform their work. In some cases, for example, the radius of gyration may be considerably reduced. A momentary halt tends to avoid this disadvantage.

The Advantage of Slow Movements. If the movements be made slowly, complete control can be exercised over the entire exercise. It is possible to ascertain that the execution is perfect in every detail. With fast, jerk type exercises, the body segment may move so fast that the eye cannot follow. More important is the fact that the body will protect itself against excessive strains, if the opportunity be given. Slow movements may provide this time. At Wilson-Bowman studios this fact is consistently taken advantage of to provide a safety measure when dealing with weak muscles. By slow movements, an oxygen debt will be incurred slowly, if at all. In certain exercises by rapid execution of the movements it is possible to contract the debt so rapidly that the burden is thrown upon the circulatory and respiratory systems. This is particularly true of the larger muscle areas. Obviously the choice of the exercise and the speed of execution will depend upon the objective desired. In one case the emphasis is laid upon the muscle and in the other upon the circulatory and respiratory systems.

The Number of Times a Movement Should be Executed. If the exercises are easy it will take a very large number of movements before effects appear. To economize on time, if for no other reason, they must be sufficiently difficult so that they cannot be performed an inordinate number of times. What would be considered excessive depends to a certain extent upon the exercise involved. In some cases it might be as few as three or four, in other cases as many as fifty or sixty. It would seem however that design should make this a constant in the progression.

Range. The exercise must conform to the requirements placed upon it by the articulations in which the movement is taking place. The normal range varies in different joints, and in the same joints in different individuals, depending upon such factors as the formation of the bones and the length of the ligaments and tension of the muscles.

(1) The Conformation of the Joints. The movements permitted depend upon the type of joint. The limiting element on the range is in some cases the shape of the bones.

(2) Ligaments and Muscles. Everyone is familiar with the limitations of the hamstring muscles in the ability to bend forward without flexing the knees slightly. In such cases the range may be considerably modified by the physical condition and degree of training. A frequent problem is to increase the range where the movement is unduly hindered by such effects.

(3) Soft Parts. In certain cases (e. g., the flexion of the forearm on the upper arm) the movement is stopped by contact of the flesh. This seldom presents a limitation unless unusual fat is present.

(4) Abnormal Limitations. Aside from these limitations which are normal, the range may be restricted as a result of breaks, strains and displacements. In other cases, the difficulty lies in the nervous system.

It is frequently desirable to utilize movements throughout the entire possible range. This is obviously true where the range should be increased. In such cases it seems that an exercise will fall short of the ideal in proportion to the extent the movement falls short of its possible scope. In certain types of movements however excellent graduation may be secured by restriction of the range. This should be permissible, provided adequate work is used to guarantee that no undesired permanent shortening of the range takes place.

Normal Movements. The exercises should consist of normal body movements in every way, that is, they should be movements which a normal body should be capable of executing. Clearly neither extreme stretching of ligaments or tendons nor contortion-inspired movements have a place in a program designed to improve the body condition. From the neuromuscular aspect only normal coordinations should be used. It has already been mentioned that complex movements are undesirable as they require excessive mental effort for the muscular work involved. If the movements are bilateral they should be designed so that the body moves symmetrically. However to provide flexibility to cope with diverse problems, movements should preferably exercise the two sides successively rather than in a combined movement. For then, when one side is notably weaker, effort can be concentrated on that side initially. After this has improved then a bilateral movement may be used. A slightly different requirement states that the ultimate objective should be a substantially even development of the entire body. No section should be stressed unduly, and thus overdeveloped, and none slighted, and thus left relatively weaker.

Psychological Desiderata. It is desirable that the exercises be designed so that the pupil may know whether they are being performed correctly. Insofar as possible they should be chosen so that it is difficult to slight them. In this way correction is unnecessary and the instructor need not assume the role of a dictator driving an unwilling pupil.

Exercises should appeal to the ambition of the pupil to master a feat, where this is compatible with the major objective. While the creation of a new skill is not a primary factor in design, it may be a powerful incentive in obtaining cooperation in execution. This is a rock upon which many monotonous arm-waving gymnastics flounder. Between two exercises which might accomplish the same end result, the one which is liked for its own

sake will show far more progress than the other which is done "because it is good for me."

Upon occasion an exercise will cause unpleasant psychological reactions. The best solution for such difficulties is to provide alternate methods of attack in the particular case.

Tetanic Contractions. On the basis that the muscles tend to maintain the position in which they have been exercised it is desirable that the exercise leave them in such a condition as would be compatible with the objective which is desired. As an example, it seems more desirable to utilize exercises in building up the tonus of the abdominal muscles that leave them in a tonic condition rather than those which leave them stretched.

A second type of exercise uses isometric contraction, i.e., "hold positions," instead of alternating movements. Where such are applicable they may offer peculiar advantages. However they may not be available in an individual case due to tendency to cramping. They are frequently simple to grade and control due to the greater ease of analysis.

Other Requirements. While it is not thought to be a primary requirement it is desirable that the esthetics of the exercise should be considered. As far as possible they should be beautiful both statically and dynamically. The positions taken should be beautiful in themselves and the movements involved in taking them should be graceful. If this is achieved the work will appear effortless and well within the capabilities of the person. This apparent ease creates an impression of grace.

Safety Factors. The major factors which contribute to safety have been mentioned:—preliminary check-up, matching the exercise to the individual, use of simple exercises, slow rhythms, normal movements, care in using stretching exercises and regard for both normal and abnormal fear reactions. A few further points complete this phase of the requirements. Normally exercises should be so designed that in case of strain the body can protect itself. To use a trite example, in bending forward and touching the floor, the knees will bend if the hamstrings are overstretched. In many cases gravity can be used so that the segments will fall into position with overwork. Thus in trunk overextension in the standing position, gravity is aiding the movement and in case of loss of control a bad strain may result. But, in the lying position on the abdomen, gravity opposes the movement and in failure restores the original position. Obviously the latter is a safer exercise from this standpoint.

Certain muscles which compress the abdominal contents may cause dizziness due to an excessive rush of blood to the head. In such cases particular care must be taken not to accentuate the condition. Adequate time must be allowed for the body to return to normal between exercises. A final requirement for safety is that the exercise should put no severe requirements upon the strength of the instructor. For, should he fail, the consequences might be injury to both.

Flexibility of Exercise. If it be assumed that the program necessitates a particular exercise and that the prerequisites therefor have been provided then the only variation which is admitted is the method of teaching, the amount of assistance by the instructor, and the number of performances.

Survey of Schools for Physical Therapy Technicians

In order that physicians might have some reliable source of information concerning the efficiency of devices for applying physical agents therapeutically, the House of Delegates in 1925 created the Council on Physical Therapy. The Council adopted nomenclature, definitions and minimum standards for apparatus which have resulted in raising the quality of advertising material directed to the profession and to the public. During its ten years of existence, less scrupulous manufacturers have been effectively curbed in their campaigns to "educate physicians" and thus promote sales of expensive therapy machines of unproved worth.

The profession has been enlightened concerning the true value of physical therapy, which lies principally in the proper application of exercise, heat and massage.

Physicians generally are better informed as to the indications for and the effects of the various forms of physical therapy. The need for assistants well trained in the technic of its application has become increasingly apparent.

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At the Cleveland session of the American Medical Association in 1934, Dr. C. B. Reed, Illinois, presented the following resolution, which was referred to the Board of Trustees for appropriate action:

WHEREAS, There is a recognized demand for qualified professionally trained physical therapy technicians in the hospitals, clinics, physicians' offices and schools for crippled children of this country; and

WHEREAS, The work of these technicians is under the direction of members of the medical profession; and

WHEREAS, The medical profession and the American Physiotherapy Association recognize the vital importance of establishing minimum standards of training and the inspection of training schools in physical therapy by a qualified and authoritative organization; therefore be it

Resolved, That the entire subject be left to the Board of Trustees of the American Medical Association, with the request that it be given careful study and consideration, and, if practical and feasible, some plan for the establishment of standards, ratings and inspections of training schools in physical therapy be effected, providing that the expense of such inspection be borne by the school requesting the same.

The Board of Trustees designated the Council on Medical Education and Hospitals as the proper body to proceed in making such a survey. Inspections of thirty-five schools for physical therapy technicians were made in connection with the regular field work of the Council's staff. Complete information was secured regarding the organization, faculty, perequisites, curriculum, physical plant, records and affiliations for each school.

In an analysis of the inspection reports the following items were of special interest:

1. *Directors of Schools.*—In twenty-four schools the directors were doctors of medicine, and in the remainder academic teachers, registered nurses or physical education instructors.

2. *Prerequisite for Admission.*—Thirteen schools placed their requirement at high school graduation. However, seven of these were regular college courses. In eight schools there was no minimum educational requirement; these represented mainly schools of the commercial type. Candidates having two years of physical education are admitted to four courses of training, and three schools limit their students to registered nurses.

3. *Duration.*—The duration of the training varies greatly, from a few weeks in some schools to eighteen months in others. In seven instances the courses conducted by a university or college requires four years. Seven schools conduct twelve-month courses of training; ten schools have nine-month courses; ten schools have less than nine-month courses; and one school has courses of nine, twelve and eighteen months.

4. *Affiliations.*—Affiliations for practice training exist in connection with twenty schools. General hospitals are used mainly, with special hospitals, clinics and institutions of various types in use in many instances. Fifteen of the schools have no affiliations to provide clinical material for practice training; in these schools the students either practice on one another or have no practical training at all.

5. *Number of Students.*—The enrolment varies from one to twelve in thirty-two schools, the average being approximately six students. Three commercial schools reported attendances of twenty-five, fifty and one hundred students.

6. *Tuition.*—Fees vary extensively. The average fee lies between $100 and $200 for nine and twelve month courses. Six schools require tuition fees of $300 and one of $400.

7. *Certification.*—On satisfactory completion of the course of training, each school endorses the graduate by means of a letter of recommendation, certificate, diploma or degree, as the case may be.

The cooperation of the Council on Physical Therapy, the American Congress of Physical Therapy and the American Physiotherapy Association was secured in determining minimum education requirements for physical therapy technicians. The following "Essentials of an Acceptable School for Physical Therapy Technicians" were adopted by the Council on Medical Education and Hospitals and passed by the House of Delegates of the American Medical Association at the Kansas City meeting, May 9, 1936:

ESSENTIALS OF AN ACCEPTABLE SCHOOL FOR PHYSICAL THERAPY TECHNICIANS

I. Organization

1. A school for physical therapy technicians should be incorporated as or under a nonprofit institution. Its board of trustees should be composed of public spirited men or women having no financial interest in the operation of the school. The trustees should serve for fairly long and overlapping terms. If the choice of trustees is vested in any other body than the board itself, that fact should be clearly stated. Officers and faculty of the school should be appointed by the board.

2. Affiliation with a college, university or medical school is highly desirable but is not an absolute requirement.

II. Faculty

3. The school should have a competent teaching staff, graded and organized by departments. Appointments should be based on thorough education and training and successful teaching experience. Nominations for faculty positions should be made in accordance with academic custom. The staff should include not less than one qualified salaried instructor and in each institution where practical training is carried on not less than one qualified physical therapist. The question of full time and part time appointments is not as important as the qualifications of the instructors, who should be specialists or exceptionally well trained and well qualified in the lines they are teaching.

III. Plant

4. The school should own, or enjoy the use of, buildings sufficient in size to provide adequate lecture rooms, class laboratories and administration offices. Adequate equipment should include anatomic charts, manikins, models, stereopticons and other aids to effective teaching. It is suggested that dissecting materials should be provided to enable each student to dissect or have the benefit of demonstration of dissection of at least the lateral half of the human cadaver. Skeletons and disarticulated bones should be supplied. There should be a library receiving regularly all the scientific periodicals pertaining to physical therapy, current numbers of which should be easily accessible to the students.

IV. Clinical Facilities

5. Provision should be made for each student to receive practice training adequate in kind and amount under competent supervision in physical therapy in a hospital or other institution acceptable to the Council on Medical Education and Hospitals of the American Medical Association.

V. Resources

6. Experience has shown that a modern school of physical therapy cannot as a rule be maintained by the income from students' fees. No physical therapy school, therefore, should expect to secure approval which does not have a substantial income in addition to students' fees.

VI. Administration

7. There should be careful and intelligent supervision of the entire school by an executive officer who, by training and experience, is fitted to interpret the prevailing standards in physical therapy education, and who is clothed with sufficient authority to carry them into effect.

8. There should be satisfactory records, showing conveniently and in detail the credentials, attendance, grades and accounts of the students, by means of which an exact knowledge can be obtained regarding each students' work. Except for good cause, such as for illness, no credit should be given for any course when the attendance has been less than 90 per cent of the full time.

VII. Requirements for Admission

9. Candidates for admission should be able to satisfy one of the following requirements:

(*a*) Two years or sixty semester hours of college, including courses in physics and biology.
(*b*) Graduation from an accredited school of nursing.
(*c*) Graduation from an accredited school of physical education.

Courses in general physics, chemistry and biology are highly recommended for all who seek to enter training in physical therapy.

10. The admission of students to the physical therapy school must be in the hands of a responsible committee or examiner, whose records shall always be open for inspection. Documentary evidence of the student's preliminary education should be obtained and kept on file. When the physical therapy school is an integral part of the university, this work usually devolves on the university examiner.

11. Advanced standing may be granted to students for work done in other acceptable physical therapy schools or hospital departments, provided the entrance requirements and other essentials herein set forth have been complied with. Official verification of the student's previous physical therapy work should be obtained by direct correspondence with the schools previously attended, and his preliminary qualifications should also be verified and recorded the same as for first-year students.

12. Complete physical examination of each student admitted should be conducted under the auspices of the school.

VIII. Publications

13. The school should issue, at least annually, a bulletin setting forth the character of the work which it offers. Such announcement should contain a list of the members of the faculty with their respective qualifications.

Suggested electives: asepsis, bandaging, first aid, history of physical therapy, hygiene, joint measurements, office routine, occupational therapy, records, social service.

All subjects should be taught by qualified teachers.

Length of course: Not less than nine months.

According to the foregoing standard the following schools have been found to comply. Several others are now in the process of making the necessary changes to fulfil the requirements.

The list of schools approved for physical therapy technicians will be maintained as a permanent part of the Council's work and revisions will be made from time to time. New schools will be considered for approval on application to the secretary of the Council on Medical Education and Hospitals of the American Medical Association.

The American Congress on Physical Therapy, organized in 1921, has done a great deal to advance the scientific knowledge of the specialty. In 1935, with the aid of the Council on Medical Education and Hospitals,

the congress established the American Registry of Physical Therapy Technicians. The objects of the Registry among others are:

"To maintain the minimum standards of educational and technical qualifications as given by the Council on Medical Education and Hospitals of the American Medical Association for technicians administering physical therapy in hospitals, clinics and physicians' offices.

"To cooperate with the Council on Medical Education and Hospitals of the American Medical Association in its investigation, classification and periodic inspection of schools which conduct training courses for physical therapy technicians."

The American Registry of Physical Therapy Technicians has indicated that graduates from schools approved by the Council on Medical Education and Hospitals will be admitted to its examinations. The offices of the American Registry of Physical Therapy Technicians are at 30 North Michigan Avenue, Chicago, and the registrar is Miss Marion G. Smith.

Schools for Physical Therapy Technicians Conforming to the Standard Adopted by the American Medical Association in 1936

School	Director	Prerequisite for Admission	Length of Course	Student Capacity	Tuition	Certificate, Diploma, Degree
Children's Hospital, Los Angeles[1]	Miss L. H Graham, R.N.	(a) R.N. (b) Grad. phys. ed.	12 mos.	6	$125	Diploma
Stanford University Hospitals, San Francisco	H. L. Langnecker, M.D.	(a) R.N. (b) Grad. phys. ed.	12 mos.	9	$175-$250	Certificate
Walter Reed General Hospital, Washington, D.C.[2]	Maj. W. W. McCaw, M.D.	Grad. phys. ed.	12 mos.	10	None	Certificate
Northwestern University Medical School, Chicago[3]	J. S. Coulter, M.D.	(a) R.N. (b) Grad. phys. ed.	9 mos.	12	$200	Certificate
Bouvé-Boston School of Physical Education, Boston [4 a]	Miss C. K. Greene, P.T., in charge	Grad. high school	3 and 4 yrs.	10	$400 per yr.	Diploma (3 yrs.) B.S. (4 yrs.)
Harvard Medical School, Course 445, Boston[5]	F. R. Ober, M.D.	(a) R.N. (b) Grad. phys. ed.	9 mos.	16	$150	Certificate
Boston University, Sargent College of Physical Education, Cambridge, Mass.[6]	Prof. E. Hermann, Dean	Grad. high school	4 yrs.	29	$365 per yr.	B.S.
Battle Creek College, Battle Creek, Mich.[7]	Paul Roth, M.D.	(a) R.N. (b) Grad. phys. ed.	12 mos.	..	$180 per yr.	B.S.
St. Louis University School of Nursing, St. Louis[8]	A. J. Kotkis, M.D.	Grad. high school	4 yrs.	6	$200 per yr.	B.S.
University of Buffalo, Buffalo[9]	G. G. Martin, M.D.	R.N.	18 mos.	6	$10 per univ. credit	B.S.
D. T. Watson School of Physiotherapy, Leetsdale, Pa.[10] (affiliated with the Univ. of Pittsburgh School of Medicine)	Jessie Wright, M.D.	(a) Grad. phys. ed. (b) 2 yrs. premed.	22 mos.	8	None	Diploma
College of William and Mary, Richmond, Va.[11]	Thomas Wheeldon, M.D.	(a) R.N. (b) Grad. phys. ed.	9 mos.	6	Coll. fee	Certificate
University of Wisconsin, Madison, Wis.[12 b]	E. A. Pohle, M.D.	(a) R.N. (b) Grad. phys. ed.	12 mos.	20	Univ. fee	Certificate

Notes

a. Four year course leads to B.S. degree from Simmons College.
b. M.S. degree for advanced work.

Affiliated Clinical Facilities

1. Cedars of Lebanon Hospital, Good Hope Clinic and Los Angeles County Hospital, Los Angeles, and Glendale Sanitarium and Hospital, Glendale.
2. Weightmann School for Crippled Children, Washington, D. C.
3. Illinois Central Hospital, Michael Reese Hospital, Montgomery Ward Medical Clinics, Passavant Memorial Hospital and St. Luke's Hospital, Chicago.
4. Boston City Hospital, Children's Hospital, Massachusetts General Hospital and Robert Breck Brigham Hospital, Boston; Cambridge Hospital, Cambridge, and New England Peabody Home for Crippled Children and Newton Hospital, Newton.
5. Boston Home for Incurables, Convalescent Home of the Children's Hospital, Children's Hospital, Harvard Infantile Paralysis Commission, Industrial School for Crippled and Deformed Children, Massachusetts General Hospital, Perkins Institute for the Blind and Robert Breck Brigham Hospital, Boston, and Cambridge Hospital, Cambridge.
6. Massachusetts General Hospital, Massachusetts Memorial Hospitals and Industrial School for Crippled and Deformed Children, Boston, and Cambridge Hospital, Cambridge.
7. Ann J. Kellogg School and Battle Creek Sanitarium, Battle Creek.
8. Firmin Desloge Hospital, St. Louis.
9. Buffalo City Hospital, Buffalo.
10. Allegheny General Hospital, Children's Hospital, Falk Clinic, Industrial Home for Crippled Children and St. Francis Hospital, Pittsburgh.
11. Sheltering Arms Hospital and Stuart Circle Hospital, Richmond.
12. State of Wisconsin General Hospital, Madison.

IX. MINIMUM CURRICULUM

Subjects	*Hours* Theory	Laboratory and Practice Training
Anatomy (including applied anatomy, demonstration on cadaver and lecture)	210	...
Clinical practice	...	400
Electrotherapy	30	45
Ethics and administration	5	..
Hydrotherapy	5	15
Massage	15	45
Pathology	30	..
Physiology	30	45
Principles of physical therapy as applied to:		
Medicine	15	30
Neurology	10	15
Orthopedics	15	30
Surgery (including surgical observation)	15	30
Psychology	15	..
Therapeutic exercise	30	75
Electives	45	..
	470	730
Total	1,200 hours	

John Hunter—Let us consider how medicine and surgery were brought in closer touch with science and came to be studied in the light of anatomy, physiology and pathology. The man who was chiefly responsible for this was John Hunter, a Scotsman. . . .

Hunter was a man of extraordinary originality, one who read few books but went directly to nature for his facts. His was a wild, unruly spirit which would not be forced into the conventional mold as regards either education or manners. The spirit of his indefatigable industry is expressed in a bit of advice from his lips: "Don't think, try." As a result, he attempted to obtain specimens to illustrate the phenomena of life in all organisms, both in health and in disease. He made thousands of human dissections alone. One tangible result of this passion for collection and study is the still extant Hunterian Museum in London. So, studying life in its widest range, he became a unique combination of comparative anatomist and pathologist.

From the Northwestern University Medical School Founders' Day address by Dr. Leslie B. Arey, October 2, 1934.

Fever Therapy Today

Rodney F. Atsatt, M.D., and Luella E. Atsatt

Fever therapy is today an almost universally accepted method of treatment for certain conditions. It is however entirely in its infancy, for fever therapy is a modality in which the potency of its treatments and the range of its application is determined largely by the trial and error method of study. This study thus far has been mostly trial on the bases of well planned experiments and very few serious errors considering the dangers which accompany the procedure.

In the potency of fever therapy treatments we have seen a gradual and orderly lifting of the estimated limits of safety as experience has shown us that the delicate protein structures of the body would successfully withstand higher and longer temperatures.

There are two schools of thought in regard to the desirability of high temperature ranges. One group entails the destruction of the invading organisms (in infectious diseases) entirely upon the thermal death point of the specific bacteria. They feel that the length and height of fever for the destruction of that particular organism can be determined by test tube experiments. These determinations are then directly applied to fever therapy with the result that often high and prolonged temperatures are advocated. Another group of workers believe that perhaps the defense mechanism of the body functions better at lower temperatures. They feel that the leucocytes, the opsonis and other immunological factors are probably more active at temperatures of medium elevation.

Time and a much more extensive series of cases will probably settle the question. Be that as it may, we have seen the so-called safe limit rise from 102-103° in the very early days of fever therapy (1929-1930) through what is now considered the moderate range of 104-105° to the present "safe limit" of 106-107° rectal.

Likewise we have seen the duration of the fever increase from a maintenance period of two hours in the early days through the stage of three to four hours to a generally accepted minimum of seven hours of sustained fever for certain infections. Furthermore there have been used by certain investigators periods as long as 22 hours of continued fever.

So much for the potency of the treatments—the height of fever has been increased gradually to what now seems a safe upper limit and the duration period seems almost limitless.

The disease which introduced fever therapy to the world was tertiary syphilis in the paretic form. Soon tabes dorsalis was found to be benefited and research workers cast about for other thermolabile organisms. The diplococcus causing gonorrhea fitted into the picture very nicely and was quickly proven amenable to this new type of therapy.

Read at the annual meeting of the American Physiotherapy Association, Los Angeles, California, June 29, 1936.

Santa Barbara Clinic, Santa Barbara, California.

It is to be noted at this point that the organisms which thus far had been successfully combatted were two which were easily killed by heat and thus the degree and length of fever were thought to be the only factors involved. However, various investigators began to try other infectious cases, those caused by organisms which were relatively heat resistant. Chronic sinus infections, chronic conjunctivitis (Keratitis), chorea, selected cases of osteomyelitis and even an hopeless stapholococcus septicemia have been treated successfully. These cases, caused by organisms which were not thermolabile, showed that there is another factor in fever therapy, namely, the increased activation of the body's defense mechanism.

Still another effect of fever therapy is seen in the treatment of atrophic arthritis where if the fever is low, 101-101.5° and the duration short, one-half to one hour, very satisfactory effects can be secured. This apparently is due to slight increases in metabolism and slight alterations in the peripheral vascular bed. (We have found that this type of therapy for these delicate arthritics is highly beneficial.)

In summarizing this discussion on range of application one must realize that there is no standard treatment in fever therapy. Each case is a problem unto itself, for each type of disease requires a different potency of treatment.

Thus we find the infections caused by thermolabile organisms responding best to high prolonged fevers on the supposition that we can actually kill off the organisms. Then we find the diseases caused by thermo resistant organisms treated with lower and shorter periods of fever on the basis that by so doing we are increasing the body's resistance or defense mechanism. Lastly we find a third type of therapy where the fever is very low and the period very short which is designed to simply stimulate metabolism and increase circulation.

As stated at the beginning of this paper, fever therapy is in its infancy and we will only learn its many possibilities and ramifications through experience.

Let us interpret the above generalizations in the following table. It represents only our personal opinion based on our own work and is far from the last word on the subject.

Disease	Height of Fever	Length of Fever	Frequency Rx	Interim
Paresis	105-106°	5 hours	1 X week	Ambulatory
Tabes	105-106°	5 hours	1 X week	Ambulatory
Gonorrheal Arthritis Urethritis Prostatitis Seminal vesiculitis	106-107°	7 hours	3 X week	Bed in Hospital
Sinus Infections	104-105°	3 hours	1 X week	Ambulatory
Chronic conjunctivitis	104-105°	3 hours	1 X week	Ambulatory
Tic Douloureux	104-105°	3 hours	1 X week	Ambulatory
Atrophic polyarthritis	101-101.5°	½-1 hour	2 X week	Bed in Hospital

The technique of fever therapy administration varies of course with the wishes and experience of the di-

rector of the department. We will outline briefly several points of technique which we consider important.

1. First and foremost—Fever therapy is always a hospital procedure with someone in charge who has had adequate training.

2. Temperature elevation shall not be more than 8/10 or 1 degree every twenty minutes. Faster rise elevates pulse, makes patient irritable. Best recorded from rectal thermocouple.

3. Sedative (Dilaudid 1/20, Scopolamine 1/100) may be given when temperature reaches 100.5° or 101°. Dilaudid 1/32 may be given as repeat in two hours.

4. Fluids largely limited to salt glucose cereal mixture—give freely.

5. Cool patient off slowly—forced decline in temperature leads to secondary rises.

6. Keep patient in bed over night in the hospital.

We have attempted to answer some questions which have arisen regarding this new modality in the treatment of disease. In our opinion fever will become one of our greatest therapeutic aids in the very near future. Let us now consider some of the devices for producing artificial fever.

Body temperatures may be raised by radiation, conduction, convection, induction or insulation. The heating lamps of Dr. Warren's cabinet (Rochester, N. Y.) well represent the production of fever by radiation. The hot bath as advocated by some authors is representative of temperature elevation by conduction. The Kettering hypertherm in which hot moist air is mechanically circulated, and the cabinet which we use, are examples of heating by convection. The use of the radiotherm, short wave diathermy and the inductotherm are instances in which fever is caused by induced currents. Simple insulation by blankets will produce a fever and Epstein (San Francisco) uses this principle in conjunction with a body baker for the elevation of the patient's temperature. Thus the avenues to artificial fever are many and diverse in principle.

The apparatus which we like best of course is the one which we have built ourselves. It is highly satisfactory, inexpensive, safe and simple. The device consists of two cabinets, the upper one suspended from the ceiling by ropes and pulleys, the lower one resting on the floor.

The lower cabinet serves as couch for the patient and for the massive production of hot moist air, subject to gross manual control. The solid center panel is margined on either side by a 4 inch grating which allows the entrance of the heated air into the upper cabinet.

The heat is produced by three 660-watt coil generators and directed upward by means of a curved tin reflector. Moisture is supplied by a full length shallow copper trough kept simmering by a flat coil heater. Thus we have hot moist air, and as hot air rises rapidly, we almost immediately have a therapeutic atmosphere in the upper cabinet without resorting to fan or other complicated apparatus.

The upper cabinet is designed not only to confine the hot moist air, generated in the box below, but has an independent delicate heating system to permit automatic fine temperature control. This is accomplished by means of ten sixty watt carbon filament bulbs so connected with a de Kotinsky double pole thermoregulator that a turn of the knob will change the cabinet temperature a fraction of a degree. The thermoregulator thus controls the temperature at any desired level as indicated by an ordinary thermometer of correct range.

The temperature of the patient is observed constantly and recorded every five minutes from an electric thermometer activated by a rectal thermocouple.

This whole fever therapy apparatus, as has been remarked is safe and simple and leaves, to us, little to be desired in our research and therapy in this new method of treating disease.

In conclusion may I repeat a remark by Dr. Bierman, a pioneer in this work. "In using fever therapy with the attendant high temperatures and grave dangers, may the attendant never forget that she holds the very life of her patient in her hands. She should never relax her acuity of mind or observation for one short moment or the damage may be done."

Technicians

When the Council on Medical Education and Hospitals first began its work in 1905, the place of the technician in medicine was not significant. Today there are technicians of many varieties. A partial list includes clinical laboratory technicians, x-ray technicians, occupational therapy technicians, physical therapy technicians, hydrotherapy technicians, dietetic technicians, anesthetic technicians, dental technicians and many others. These professions, auxiliary to the practice of medicine, have grown up as the need for their services became apparent. Obviously their growth was uncontrolled and unstandardized since the exact need had not in itself been defined and since the new technical discoveries on which their services depend had not yet been even partially developed. Now, however, the significance of these auxiliary professions is becoming apparent. For that reason the Council on Medical Education and Hospitals in response to resolutions coming through the House of Delegates of the American Medical Association has undertaken an investigation of the available schools in the fields of physical therapy, occupational therapy and laboratory service and has set up certain minimum standards of education to guide students who wish to affiliate themselves with medicine in these fields. The standards for such schools are listed in this issue of THE JOURNAL.

There seem now to be available thirteen schools for physical therapy technicians which conform to the standards adopted by the American Medical Association. In

Editorial reprinted from Journal of American Medical Association, August 29, 1936.

its survey the Council inspected thirty-five schools and received complete information concerning their organization, faculty, prerequisites, curriculum, physical plant, records and affiliations. In the work the American Congress on Physical Therapy and the American Physiotherapy Association cooperated.

One hundred and ninety-six schools for the training of clinical laboratory technicians were visited by the investigators of the Council on Medical Education and Hospitals, and ninety-six of these schools were found to conform to the standards adopted by the American Medical Association. The American Society of Clinical Pathologists did the pioneering work in this field and lent its assistance to the Council in this study of schools for clinical laboratory technicians. The number of students in such schools varied from none in some of the schools that were found acceptable to 182 in the University of Minnesota. Incidentally, the next larger schools after the University of Minnesota boasted of thirty, twenty-three, and twenty-one students respectively. In all, there are ten universities and colleges which have established courses with a graded curriculum covering four years and leading to a university degree.

In the field of occupational therapy the Council has set up the essentials of an acceptable school and has investigated a considerable number of institutions. However, the specialty is in itself so new and the schools thus far on such an experimental basis that the Council has set Jan. 1, 1939, as the date on which such schools shall have set up an acceptable standard and curriculum before providing a list of acceptable schools.

Today medicine consists not of one profession but of many professions. In addition to the 155,000 physicians licensed to practice there are well nigh 1,500,000 people engaged in full time service for health and for the sick. In a profession closely allied to the welfare of mankind, greatly concerned with the safety and health of human beings, there must be minimum standards of education, morals and practice. In accepting these new responsibilities, the Council on Medical Education and Hospitals continues to render an efficient and useful service for the advancement of medicine and the welfare of the public.

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The Place of Colon Therapy in the Mentally Ill, HAROLD K. MARSHALL, Med. Red., 144:1:8, July 1, 1936.

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The Physiotherapy Review

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Salary Survey

At the annual session of the American Physiotherapy Association in Los Angeles a salary survey was suggested. After a short discussion it was given to the executive committee for further consideration.

We feel that such a survey will be of great aid in establishing salary standards for physical therapists. During the past six years, we know that physical therapists among others have been receiving inadequate financial return for their services not to mention lengthened hours and more work. It was revealed under the NRA that hospital maids could demand and received a higher salary than the trained physical therapists.

It is recognized that the cost of living varies in the different sections of the country and that one minimum salary for all cannot be established. It is unfair however to have a wide divergence of salary in the same locality. In one city three organizations receiving aid from the Community Fund employed physical therapists. The salaries paid by one organization far exceeded the other two, although the work and responsibility was not greater and the same standard of training was required.

Salaries are being established by Civil Service commissions in many states who are organizing crippled children's work under the Social Security Act. Since we have no statistics with which to advise them, the salaries will be based on figures of other professions, such as Public Health Nurses or Social Workers.

New students considering the field of Physical Therapy have the right to know what their approximate return will be on their investment. It is not enough to sit back and generalize. A survey of hospitals, clinics, Visiting Nurse Associations, school systems, and private offices in all sections of the country will enable us to give advice not only to our members but also to employers. Let us proceed with this project immediately. In urging this we are not forgetting that we have a definite responsibility to our patients, and that unless we enter the profession with a feeling of service we are not worthy of it.

Notices

CHAPTERS

Please notify the Review of all changes in officers and addresses.

MEMBERS

Reviews are not forwarded. All address changes should be in by the 10th of the month preceding the publication.

MEMBERS-AT-LARGE

It is not necessary to belong to a chapter to send us any papers which you may wish to have published. All papers may be submitted to the Editorial Office, 303 East Chicago Avenue, Chicago, Illinois.

ACADEMY OF PHYSICAL MEDICINE

The Academy of Physical Medicine will hold its Annual Meeting in Boston at the Hotel Statler on October 20, 21 and 22, 1936.

The three-day program will open with reports, surveys and presentations on fundamental subjects. Dr. Frank Hammond Krusen will present his Presidential Address on "The Present Status of Physical Medicine." A fever therapy symposium is scheduled for the afternoon. This will be followed in the evening by the Arthur H. Ring Foundation Lecture by Dr. Stafford L. Warren on "Fundamental Principles Concerned in the Treatment of Gonococcus Infections by Artificial Fever Therapy" at Arlington. On the second day will be a symposium on physical education when the Academy will be addressed by Josephine Rathbone, Ph.D., Teachers College, Columbia University; Harold T. Edwards, A. A. of the Fatigue Laboratory, Harvard College; Dean Ernst Hermann, Sargent College.

Papers on orthopedic subjects will be presented by Dr. Frederic Jay Cotton, Dr. Fred H. Albee and Dr. Gordon Morrison. Dr. Abraham Myerson, Dr. H. Houston Merritt and Dr. Isador Coriat will present neurological subjects. Dr. Rebekah Wright will discuss hydrotherapy technique.

All members of the medical profession are invited to attend. Members of the American Physiotherapy Association are cordially included in this invitation.

A program will be mailed on request by writing to William D. McFee, M. D., Chairman of the Executive Committee, 41 Bay State Road, Boston, Massachusetts.

ABSTRACTS

John S. Coulter, M. D.

The Role of Physical Therapy in Orthopedic Surgery

Frederick J. Gaenslen, M. D., Milwaukee, Wis., in J. Bone & Joint Surg., XVIII:3:559, July, 1936. (Presented at the annual meeting of the American Orthopedic Association, Milwaukee, Wis., May 19, 1936.)

Since the work of the orthopedic surgeon deals very largely with the function of the locomotor apparatus, and since physical therapy ministers to a large proportion of patients with dysfunction of the locomotor apparatus, there is perhaps a closer relationship between physical therapy and orthopedic surgery than between physical therapy and any other specialty. It therefore behooves us as a group to recognize not only the virtues but also the limitations of physical therapy in order that this important branch of therapy may be included in our program of treatment when indicated, and also that the younger men coming under our influence may be given an opportunity to form their own opinions from observation of the use of these measures in impartial hands rather than from the sales talks of manufacturers' agents.

Rest

The need of rest to the injured part in the case of a fracture to allow the repair process to go on without interruption is self-evident. The initial process of repair may be visualized as an attempt on the part of newly formed connective tissue and the accompanying vessels to bridge the gap between the fragments. If these attempts are constantly aborted, repair cannot take place. In the acute inflammatory process, rest is necessary to avoid dissemination of the invading organisms along fascial planes and tendon sheaths with a breaking down of nature's barriers of defense and the exhaustion of efforts at repair.

Heat

It is generally accepted that heat causes relaxation of tissues, relief of muscle spasm, increased blood supply, and, consequently, improved nutrition. Goldschmidt and Light, in studying the effects of local heat on blood chemistry, found that the venous blood returning from the heated part showed diminished oxygen content, while the carbon-dioxide and lactic-acid content was increased. In other words, warmed tissues withdraw and use oxygen in greater amount, while waste products and presumably toxic material, if present, are eliminated more efficiently. That adequate blood supply favors defense against infection and promotes repair and growth of tissues is proved by abundant clinical observation.

Massage

Massage as a therapeutic measure is universally accepted and widely employed. In treating recent injuries, following the teaching of Championniere, Mennell, and others, massage should be very light and rhythmic. If so administered, it is helpful in relieving pain and in relaxing muscle spasm, as well as spasm of vessel walls. As a consequence of this relaxation, there is a markedly increased flow of blood and lymph, with a resulting increase in local metabolic activity, conducive to tissue repair. This stimulating effect upon the circulation is commonly regarded as a reflex effect, proof of which may be seen in the moving picture films prepared by Clark and Swenson, which shows the capillary circulation in the rabbit's ear. Gentle stroking of the ear was followed by marked widening of the capillaries and a tremendously increased rate of flow.

Exercise

Active exercise is perhaps the most valuable of all forms of physical therapy because it calls into play the entire neuromuscular apparatus. This apparatus consists of three distinct parts: the upper and lower neurones and the contracting muscle cell; the inhibitory mechanism providing for finely graduated, precise movement; and the mechanism insuring relaxation of antagonistic muscles.

Thus the voluntary effort involves function of the entire complicated mechanism which cannot be claimed for any other form of physical therapy. Accompanying muscle contraction there is compression of the lymphatic and venous channels, while during muscular relaxation these vessels fill rapidly from the capillary side. Stasis is overcome and acceleration of the blood stream must result. Clinical evidence of the results of diminished blood supply is afforded by the pale muscle of the paralytic limb, the decalcified bone in disuse, and the cold extremity following inactivity.

In the healing of fractures, early motion is desirable because motion causes pressure on the immature callus and pressure exerts a trophic influence favorable to ossification. This explains the value of limited weight-bearing in delayed union; but internal stress on the bone, as Carey has shown, may be brought about by muscular contraction, a dynamic force, as well as by the static force due to transmission of body weight. In fact, the dynamic stress due to muscular contraction may far exceed the static stress. As long ago as 1894, Roux called attention to the facts that functional stimuli have trophic effects, that under the influence of tension young connective tissue is transformed into strong fibrous tissue, and that pressure, either alternating with tension or without tension, produces bone. In his admirable book on bone formation, Jansen goes a step farther and brings evidence to prove that, contrary to Wolff's law, bone is laid down not in response to trophic stimuli of both tension and pressure but to pressure alone. He states that fibrous tissue which has been submitted to tension remains fibrous throughout the life of the individual. That fibrous tissue, interposed between fracture surfaces, can be transformed into bone or replaced by bone, if the shearing force is eliminated, has been proved by the writer in experimental work on the dog. In a number of dogs the neck of the femur was cut through with a chisel and a full thickness flap of capsule, completely covering the fracture surfaces, was interposed. Reduction was maintained by internal fixation secured by three knitting needle spikes. Tension or shearing force was thus replaced by pure stress or pressure, and, in the five cases in which healing was allowed to progress for four months

or longer before the animals were sacrificed, bony union resulted. In fractures of the ribs, where apposition is secure and function is uninterrupted due to respiratory movements, healing takes place in a minimum of time. The closer we can approach this ideal of accurate reduction and uninterrupted function, the happier will be our results in fractures. Sling-suspension exercises, balanced traction, and other similar devices, under-water exercises, and in short, any method which will allow motion of the neighboring joints at an early date without jeopardizing the position of the fragments, should be utilized in the treatment of fractures. Murray and others are of the opinion that not infrequently disability after injury may be prolonged by the patient's reliance on the physical therapist to bring about his recovery by the application of some of the newer so-called modalities, with the resultant comparative neglect of the much more important voluntary effort in the rehabilitation program. The surgeon will do well to devote some time to the provision and proper arrangement of simple apparatus and to the supervision of at least the initial efforts of the patient. "Muscle setting," or static exercises with the limb still in plaster or splint, is also valuable, not only in diminishing joint stiffness, but in providing the trophic stimulus conducive to bone formation as a result of the dynamic stress.

Occupational Therapy

Occupational therapy deserves special mention. When properly employed with active exercise as its basic principle, it is without doubt one of the most valuable adjuncts to physical therapy.

Posture

In the reconstructive program the question of posture is often given insufficient consideration. This holds true for the posture of a part of the body which often results in preventable deformities and disabilities such as adduction contraction of the shoulder and foot drop as well as for the body as a whole. It is deplorable to see crippled arthritics hunched up in bed or in wheel chairs, exemplifying every vicious feature of defective posture. Swaim has demonstrated before this organization how much can be accomplished by way of correction and how important this correction is in the general physiology.

Irradiation and Diathermy

As to diathermy, I will quote Coulter: "Well-established evidence indicates that local application of heat is effective as an adjunct in the treatment of certain traumatic and inflammatory changes in bones, bursae, muscles, ligaments, and tendons. Both long and short wave diathermy are effective methods of applying heat and can be used to advantage for many of these conditions. There is no available evidence that medical diathermy has any effect other than that due to heat produced."

The Fever Treatment of Early Syphilis

Editorial in Am. J. Syph., 20:4:445, Part 1, July, 1936.

In the Journal of the American Medical Association issue of December 28, 1935, Simpson reports the results of the treatment of early syphilis, latent Wassermann-fast syphilis, and neurosyphilis, with artificial fever in combination with chemotherapeutic agents. Since the value of fever in the treatment of neurosyphilis is fully established, and since the studies of the Cooperative Clinical Group have shown that the results of chemotherapeutic treatment of latent Wassermann-fast syphilis are satisfactory without fever therapy, his report is of interest mainly because of his use of fever in the treatment of twenty-six patients with early syphilis.

In his discussion of Simpson's paper, Stokes points out that as a result of the Cooperative Clinical Group's studies we now have a highly satisfactory plan of treatment for early syphilis which has been evaluated by the study of an unusually large group of patients. He urged that the position of this treatment plan be not jeopardized by attempts to apply a new and untried method which demands a high degree of specialization. Stokes' remarks are of sufficient importance to warrant further emphasis.

The plan of treatment for early syphilis recommended by the Cooperative Clinical Group was not evolved suddenly from their preconceived ideas of how early syphilis should be treated but was arrived at from an extensive study and comparison of the various treatment schemes which have been proposed since the discovery of arsphenamine.

The authority of this great amount of material, followed for so long a time, precludes the adoption of other treatment schemes which have a less substantial background. This is particularly true of fever therapy for two reasons:

In the first place, fever and chemotherapy in the treatment of early syphilis have been tried and found less satisfactory than other treatment plans. Malaria combined with courses of neoarsphenamine was used about fifteen years ago and was abandoned because the immediate satisfactory results were not confirmed by subsequent developments. There is at present such insufficient evidence that mechanical methods for producing fever have any advantage over the older method of malaria therapy that a reopening of the question seems inadvisable.

In the second place, the proposal to use hyperpyrexia jeopardizes the advances that have already been made in the treatment of early syphilis. The knowledge that the treatment of syphilis requires at least a year has gradually been accepted by a small but appreciable part of the lay population. This knowledge has been gained very gradually during the past ten years from various sources, the most important of which have been the larger syphilis clinics. It has been disseminated for the most part by patients under treatment or observation for syphilis in these clinics. However, during the last four or five years, numerous articles concerning fever therapy have appeared in the lay press. They have varied from sane accounts of the use of fever in the treatment of disease to stories of physicians using fever to produce a sturdier crop of corn. The layman is unable to judge the value of these articles and, as a result, the patient with early syphilis may become the victim of the less capable or the dishonest physician. If this happens it will not be long before both patient and physician become as confused as they were in the years immediately following the advent of arsphenamines.

Clinical Notes on the Results of Fever Therapy in Different Diseases

Report of the Fifth Annual Fever Conference, Dayton, Ohio, May, 1935

Philip S. Hench, M.D., Rochester, Minn. in Minn. Med., 19:3:151, March, 1936.

Gonorrheal Urethritis, Epididymitis, and Pelvic Disease.—The great majority of about ninety-five men with acute urethritis were promptly cured by a few sessions of fever (each of about five hours at 106° to 107° F.) as were also most of forty-four with acute epididymitis and several with acute prostatitis. Smears and gonococcal complement fixation tests became negative.

Patients with chronic infection may need supplementary local treatment. Of 118 additional patients with genito urinary gonorrheal infection treated by one session (five to seventeen hours of fever at 106.7° F. (41.5° C.)) 80 percent became clinically and bacteriologically negative and have remained so for three months to three years. In the treatment of gonorrhea of the female pelvis the combined use of fever therapy and either pelvic diathermy or Elliott treatments may be more effective than fever therapy alone. By the combined method of fever therapy and the Elliott regimen, one or two less treatments are necessary than with fever therapy alone. Some workers insisted that vaginal or rectal diathermy is a more effective supplemental treatment than the Elliott regimen.

Gonorrheal Arthritis.—Of a total of 143 patients with gonorrheal arthritis about 70 percent became symptom free and 10 percent received marked relief from fever therapy. In about 20 percent of the cases little or no relief was obtained.

Neurosyphilis.—Regardless of the thermogenic methods used, clinical remissions should not be expected in more than 50 percent of cases. Of a group of patients with paresis who were treated by diathermy fever and chemotherapy, in only about 25 percent was the disease arrested as compared to clinical remission in 49 percent of those treated by malaria and chemotherapy. The statistics of other workers, however, favor artificial fever rather than malarial fever.

Primary and Early Secondary Syphilis.—Because of results obtained in late syphilis, and in order to prevent the occurrence of the latter if possible, the combined use of fever therapy and chemotherapy has been advocated in the treatment of early syphilis. A minimal course is ten sessions of five hours each, at a temperature of 105° to 106° F. (40.5° to 41.2° C).

Chorea

Results in twenty-eight cases of Sydenham's chorea were reported. Each patient was subjected to from four to twelve fever sessions, each session being three to four hours at 104° to 106° F. The majority were notably improved, and many were cured.

Sub-Acute Bacterial Endocarditis

Results of fever therapy in eight cases of subacute bacterial endocarditis would indicate that it may prolong the patient's life and make him more comfortable for a while. Patients may have less fever and night-sweats and may gain weight thereafter. Blood cultures generally remain positive and alterations in the size of the liver and spleen, and in the character of the urine, are generally unchanged. Death apparently is but postponed.

Nonspecific Arthritis

Of 129 patients with atrophic (infectious, proliferative, rheumatoid) arthritis who were treated by fever therapy less than 10 percent became symptom-free; about 30 percent obtained notable relief. The results were in general disappointing but were better in acute cases.

Asthma

Fever therapy was employed in at least twenty-five cases of intractable asthma of the intrinsic or allergic type. None of the patients had previously received appreciable relief from other measures. Many were markedly incapacitated and unable to work. Some required oxygen and had been placed in an oxygen tent. The relief was but temporary, remissions lasting only one to three and a half months. Further treatment induced subsequent remissions. One worker noted no relief in three cases.

Peripheral Vascular Diseases

In the treatment of peripheral vascular diseases by fever one should be content to produce vasodilation and not try to kill some unknown causal bacteria. Temperatures greater than 102° F. may initiate serious skin burns or provoke gangrene. Reduction of claudication and pain and improvement in collateral circulation were noted in three cases of thromboangiitis obliterans and in two cases of obliterative arteriosclerosis. Six sessions of fever each of four to five hours at a temperature of more than 102° F. were employed.

Ocular Lesions

Gonococcal iritis responds notably to fever therapy. Good results were reported in the treatment of specific and nonspecific ocular lesions of the ulcerative type, in iritis, in syphilitic keratitis, and phlyctenular keratoconjunctivitis, and particularly in the exudative lesions of ocular syphilis. Evisceration of an infected eye subsequent to a penetrating wound was occasionally avoided by fever therapy. In ocular syphilis, fever therapy is best combined with chemotherapy. Optic atrophy is not a contraindication to hyperpyrexia.

Untoward Reactions

Numerous physiologic studies have shown that the amounts of fever generally prescribed do not harm patients. Electrocardiographic studies, for example, show no significant cardiac alterations. By now many hundreds of patients have been so treated. Only a very few deaths attributed to uncontrolled hyperpyrexia have been reported. In one series of 400 patients treated by a trained personnel, no disasters were encountered. Impending cardiovascular collapse can generally be recognized by the presence of a persistent pulse rate of 160 or more, and one of poor quality. In such cases the session of fever should be stopped or the fever temporarily reduced. If marked vasomotor depression or collapse occurs, 100 c.c. of 50 percent glucose solution should be given intravenously, and caffeine or epinephrine as necessary. The inhalation of oxygen and carbon dioxide is helpful. A blood transfusion may be useful.

An occasionally serious and even fatal reaction is probably inevitable, as the administration of five to eight hours of fever at 106° to 107° F. puts some patients close to the borderline of disaster.

Conclusion

To date fever therapy, an essentially safe procedure when supervised by physicians and nurse-technicians trained in its administration, is chiefly of value for the venereal diseases, gonorrhea and syphilis, diseases in which actual bacteriolysis or destruction of the invading organisms can be accomplished. Further observation may indicate it to be very useful in certain other conditions also. The presentation of these preliminary observations on its use in a few cases of a wide variety of diseases should not foster unwarranted claims or lead to its haphazard administration, but it will indicate the trend of investigation and current opinion as to its field of usefulness.

The Therapeutic Use of Local and Systemic Temperature Elevation

William Bierman, New York, N. Y., in Med. Rec., 143:6:250, March 18, 1936.

The question arises as to whether tissues at a depth may be heated in a superior manner by short wave currents as contrasted to diathermy. In general it appears as if this is so. If tissues were all homogeneous, there

would be no special advantage in using short wave currents rather than diathermy or longer wave currents. In areas composed of heterogeneous tissues, the short wave currents have the advantage in that they can heat the tissues more uniformly.

We have gained the impression that in general the short wave current may be used for the treatment of those conditions for which medical diathermy has shown itself to be of value. These conditions include such pathological states as bursitis (especially about the shoulder joint), traumatic tenosynovitis, myositis, myofacitis, sprains, and arthritis. The types of arthritis treated with most satisfactory results are the traumatic and gonorrheal. The problem of infectious or rheumatoid arthritis is complex because of the focal and systemic factors. Local joint heating is one of the adjuncts of the treatment of this condition. In many of our patients the vertebral and the sacro-iliac joints were involved with pain distribution along the course of the sciatic nerve.

Our experience leads us to believe that the use of heat is of value in the treatment of paranasal sinusitis. We have seen individuals suffering from pains due to the involvement of ethmoid, sphenoid, frontal, and maxillary sinuses secure marked relief following the application of diathermy applied by means of a specially constructed cast following the use of the short wave currents. Many of these patients had for years been under treatment by nose and throat specialists of good standing and of undoubted ability. The nose and throat specialist should add this form of treatment to whatever else he believes to be of value in treating both acute and chronic sinusitis. Here, as elsewhere, the surgical principle of adequate drainage is an important one.

Short wave currents have the advantage of ease of application not only over areas of infection but also over other regions such as the ear, the eye, the nasal sinuses, and the lower spine.

It is possible to elevate the temperature of the body by other physical means than short wave currents. Diathermy will do it if applied by sufficient current strength. So will heated air, particularly if it has a high degree of humidity. We have found the hot water bath to be an excellent method. Our technique varies somewhat from that described by other workers. We start our patients in water at about 37.8° C. and gradually raise the temperature of the water to about 42.2° C., increasing the temperature of the water about 1.1° C. every five minutes. We have found that by this means we can usually achieve a temperature elevation to about 41° C. within approximately forty-five minutes. The patient is then transferred to a bed and surrounded by a hood containing electric light lamps. The patient is kept underneath this hood for a period of four, five, or more hours, depending upon the condition that is to be treated.

A treatment such as this is a strenuous one. The patient is prepared by a cleaning out of the bowels by means of an enema; he eats a light breakfast consisting of crackers and milk, or coffee and rolls. We usually find it necessary to use sedatives such as sodium amytal and morphine sulphate. He is given as much fluids as he desires, particularly water containing 0.6 percent of salt. To make him more comfortable it is sometimes necessary to place a cool towel on his forehead or to turn an electric fan on his face.

It is absolutely essential to keep continuous and careful watch of the systemic temperature. To ignore this would be to invite fatalities. Whenever we can, we prefer to use a resistance thermometer which indicates the rectal temperature continuously so that we may know it at any instant. Lacking such an instrument, it becomes necessary to take the rectal temperature by means of the usual clinical thermometer at least every ten minutes, and at the higher temperature ratings, every five minutes. As a rule it appears to be a safe procedure in the healthy adult to permit his temperature to go as high as 41.5° C. Beyond this temperature, conditions become hazardous. The pulse rate, which should be taken at frequent intervals, is another objective guide. We feel that if it goes beyond 160 beats per minute the treatment must be continued with caution, if at all.

As a result of the fever, great changes occur in the body's activities. The increase in the pulse rate averages about eight beats per one-half degree C. of temperature elevation. The velocity of blood flow may be increased as much as four hundred percent. Marked peripheral vasodilatation occurs as evidenced in the color of the skin and by the rise in its temperature. The systolic blood pressure may rise slightly, while the diastolic blood pressure may fall to zero. This period of lowered diastolic pressure is, however, a temporary one so that the original level becomes restored within about two hours. There occurs a marked increase in the number of leucocytes. The increase may be as much as one hundred percent. The leucocytes also show increased phagocytic activity.

The Modern Management of Pulmonary Tuberculosis in the Adult

Julius P. Dworetzky, M. D., F. A. C. P., Liberty, N. Y., in Med. Times & L. I. M. J., 64:6:171, June, 1936.

Once a diagnosis of pulmonary tuberculosis has been made, a very important step confronts the physician; namely, the correct treatment for the particular case under advisement. An experienced physician knows that no two patients are alike. Reactions depending upon temperament and physical make-up differ in almost every patient. Each patient, therefore, must be individualized.

To return to the basis for all treatment—rest—this point cannot be too heavily stressed. Every case of tuberculosis presenting symptoms should be considered as an active case and absolute bed rest is indicated. A good rule for the physician's guidance is that as soon as a diagnosis is made the patient should be put to bed for a period for observation. During this period a decision can be reached as to the course of treatment to be followed: whether the case calls for some form of collapse therapy, or whether rest plus hygienic measures will suffice. Where collapse therapy is found unsuitable or cannot be employed, bed rest alone must be resorted to. It must always be understood, however, that collapse therapy is but an adjunct to bed rest.

Collapse Therapy

The most accepted forms of collapse therapy are artificial pneumothorax, operations on the phrenic nerve, pneumolysis (cauterization of adhesions), and extrapleural thoracoplasty.

Cases Suitable for Bed Rest Alone

There is no hard and fast rule by which cases may be selected for bed rest treatment. Generally speaking, bed rest alone is indicated in those cases where the lesion is small and of the exudative type, especially when the sputum is negative; also in those which present small and recent cavitations. Such cases are entitled to a period of observation and in many of these cases a few months in bed will clear up the lesion.

Graduated Exercise

Although the healing of a pulmonary lesion is accomplished mainly through rest, both local and general, each patient during the latter part of the treatment should be allowed graduated exercise, which is best taken in the form of walking. Exercise should be begun when all toxic symptoms have disappeared, when the x-ray film demonstrates that the lesion is beginning to undergo fibrosis and calcification, and when the sputum is preferably negative. The exercises should be graduated according to the patient's condition and, personally, I find it convenient to grade the exercises in nine activities as employed at the Otisville Sanatorium, Otisville, N. Y.:

Activity O—Absolute bed rest.

Activity I—Patients on bed rest with bathroom privilege.

Activity II—Patients on modern bed rest with bathroom privileges; allowed to sit up two hours in the morning on a cure porch and have the noon meal in the dining room.

Activity III—Patients may sit up on the cure porch for three hours in the morning and have all three meals in the dining room.

Activity IV—Patients may have all the privileges of Activity III. These may attend church or movies, or both, once a week. Walking exercise fifteen minutes once a day.

Activity V—All privileges of Activity IV. Walking exercise from fifteen to thirty minutes twice a day.

Activity VI—All privileges of Activity IV. Walking exercises from thirty to sixty minutes twice a day. May play cards one hour in the evening.

Activity VII—All privileges of Activity VI. Walking exercises for one and one-half hours twice a day.

Activity VIII—Al privileges of Activity VI. Walking exercises for two hours twice a day.

When a Patient May Be Considered Well and Able to Return to Work

When a patient has reached Activity VIII and is able to carry on without loss of weight or return of any symptoms, he may be allowed to return to his usual work provided it is not too laborious. Here too each case must be individualized and judged on its own merits. Some cases heal faster than others, some heal in a few months (resolution), others may take five years, and still others never heal at all. I find that in my practice the following signs and symptoms serve as a practical guide in determining when a patient is well and able to return to work:

Patient must be free from all toxic symptoms.

He must be rid of cough.

Expectoration must be nil or very slight.

Sputum must be negative on concentration for at least one year.

In infiltrative lesions, x-ray film must show resolution, retrogression, fibrosis or calcification.

If a cavity existed, it must be closed or obliterated as shown on x-ray film.

The general condition must be satisfactory.

Sunlight and Health

An editorial in Jour. A.M.A., 106:24:2071, June 13, 1936.

The belief that sunlight exerts a beneficial effect on health is at present exceedingly popular. Its general endorsement by the public is visible during the summer months at the beaches and summer resorts. The growing tendency to continue the "sun bathing" throughout the year is indicated by the increasing numbers of "sun lamps" available on the open market and the rather large numbers of these devices purchased by the American people for use in their homes. But what is the scientific knowledge regarding the effects of sunlight and of ultraviolet rays on health? Does such information indicate a need for excessive basking in the sun's rays or does it suggest that this practice is unnecessary or perhaps even undesirable? Laurens has recently reviewed the available knowledge in this field.

The question of the effects of the rays that are transmitted by the stratum corneum into the deeper layers of the skin has received wide attention. Certain beneficial effects are well known, as, for example, the favorable influence of the ultraviolet rays on the assimilation of calcium and phosphorus, and the resultant prevention or cure of rickets due to the formation of vitamin D in the skin. Favorable effects of moderate amounts of sunlight on the blood and circulation have also been described, particularly in increasing the platelet count in cases of idiopathic purpura haemorrhagica and as an adjuvant to diet and standard therapy in the treatment of secondary anemia. "Sunshine" carbon arc radiation has been alleged to cause a temporary decrease in both the systolic and the diastolic blood pressure in patients with essential hypertension. Natural sunlight, according to a number of authorities, hastens the healing of sluggish, indolent wounds by its local effect on the circulation of the blood and may be of benefit in tuberculosis of the skin (lupus vulgaris). Many believe that heliotherapy constitutes a valuable aid in the treatment of pulmonary tuberculosis. However, perhaps as many equally competent authorities feel that the results are "not likely to be spectacular and its omission not detrimental to the patient's best interest."

Harmful as well as beneficial effects may result from exposure to sunlight. Under certain conditions, as yet none too well defined, photosensitization may occur and the patient so sensitized may experience serious reactions on subsequent exposures to sunlight. A number of skin diseases, such as urticaria solaris and lupus erythematodes discoides, are probably due to this type of sensitization. Likewise it is well known that prolonged exposure to sunlight may cause not only inflammatory and degenerative changes in the skin but also systemic disturbances. One authority has stated that over-exposure to sunlight may bring about damage to the central nervous system, especially the brain, as a result of heating of the skull.

Acute Arterial Occlusion of Extremities

Geza de Takats, M.D., VM. Surg., F.A.C.S., Attending Surgeon, St. Luke's and Research and Educational Hospitals, Assistant Professor of Surgery, University of Illinois; in Am. J. Surg., XXXIII:1:60, July, 1936.

Another conservative measure to combat the concomitant vessel spasm is the alternating negative and positive pressure apparatus for patients with acute arterial occlusion. The relief from pain is often quite dramatic and cases have been reported in which high arterial occlusions have been successfully treated without loss of any tissue. While I have had a number of such machines at my disposal since April 1934 and have had the opportunity to treat five acute vascular occlusions with the suction apparatus, I have not been able to satisfy myself of a definite immediate benefit derived from its use. It is true that at least three cases were submitted to this treatment after forty-eight hours and were hopeless. But

one case has left a deep impression on me in regard to the relative merits of papaverine and negative pressure treatment. This fifty-one year old patient had a severe coronary occlusion with auricular flutter. Two weeks later the right foot became cold and cyanotic but gradually improved. A few days later, or twenty-three days from the onset, the right femoral artery became suddenly occluded. All toes showed discoloration and the skin began to blister. Passive vascular exercise with the Reid-Herrmann apparatus was started about twelve and one-half hours after the embolism which seemed to relieve the pain but did not improve the circulation, although treatments were given from five to seven hours a day. When I first saw the patient twelve and one-half hours after the vascular occlusion, there were no pulses in the pedal and popliteal arteries, the oscillometric curves were absent as high as the midthigh, and the histamine reaction was negative below the knee. A diagnosis of femoral embolism at the bifurcation of the deep and superficial femoral was made. Papaverine hydrochloride was given intravenously twice a day and continued for four days. Soon after the first injection a marked change took place in the color of the affected extremity; it became pink and the cyanosis of the toes disappeared. While the patient went through a mesenteric, a cerebral, and another coronary occlusion, he is still alive eleven months after the embolism, with a sustained circulation of the affected limb.

In this instance the papaverine seemed to relieve the vessel spasm much more readily than the suction apparatus. The value of the latter, I believe, lies more in maintaining and gradually improving the gain in collateral circulation.

Recently Lehman suggested the elevation of the environmental temperature by blankets and a heat cradle to overcome the vessel spasm of collateral channels following sudden occlusion of main vessels. This suggestion merits serious consideration and could be well combined with papaverine and passive vascular exercise.

Conclusions

The study of the literature and my own material has led me to adopt the following attitude in cases of acute arterial occlusion:

An attempt should be made to differentiate between embolism and thrombosis, keeping in mind the possibility of traumatic segmental vessel spasm and venous or lymphatic block with secondary vessel spasm.

One must try to localize the site of occlusion and determine, on the basis of the patient's age, cardiovascular status, and the known incidence of gangrene from occlusion at that site, whether or not a gangrene is to be expected.

It is necessary to utilize vigorous conservative measures, including heat, dependent position, papaverine and negative pressure, if available, with the purpose of overcoming the concomitant vessel spasm.

Should these measures fail and equipment be available, an embolectomy is indicated, especially if the patient is seen within the first ten hours.

If these measures fail, or if gangrene is present, amputation is indicated at the level of adequate circulation if there is a chance to save the patient's life.

A less passive attitude in regard to these peripheral vascular crises which are still being ignored or treated with indifference will lead to an improvement in the mortality of statistics of life and limb.

Blood Changes in Exercise

D. B. Dill, Ph.D., Boston, Mass., in Jour.-Lancet, LVI:6:313, June, 1936. (Read before the Sixteenth Annual Meeting of the American Student Health Association, New York City, Dec. 27, 1935.)

Hard muscular work is accompanied by a leucocytosis which may be as great as 200 or even 300 percent, the rise depending on duration and intensity of the work. The first stage may be lymphocytosis, but this may be followed by a polynuclear stage. There may be no drop for two hours after a game and recovery may not be complete for several hours. The picture so closely resembles that of appendicitis that mistakes in diagnosis are possible.

It is well known that there is an increase in red cell count during and after exercise. This is usually of the order of 5 to 10 percent.

Moderate exercise is paid for by the oxidation of carbohydrate and fat and does not involve the accumulation of lactic acid. For every individual there is a critical intensity of work above which lactic acid accumulates —a sign that the supply of oxygen to some muscles is deficient.

Lactic acid accumulates in the muscle in anaerobic work and diffuses very rapidly into the blood. Its speed of diffusion is indicated by the very small gradient between blood in the femoral vein and the artery. This means that there is no rapid rate of removal of lactic acid from the blood in other parts of the body. There is a large decrease in concentration as the blood passes through the arm, because idle tissues act as a sink for lactic acid. At first sight these two statements may seem contradictory, but in fact they are not: the point is that in the early stage of recovery the rate of flow to the arms and other peripheral areas is slow so that large gradients of lactic acid, CO_2 and O_2, are possible. That there is an extremely rapid rate of flow through the legs is shown by the small gradient in oxygen content between the artery and vein despite the high metabolism.

The Post-Exercise Suppression of Kidney Function in Man

Frances A. Hellebrandt, C. Etta Walters and Mary Louise Miller (From the Department of Physiology, University of Wisconsin); in Am. J. Physiol., 116:1:168, June 1, 1936.

Violent exercise is associated with a modification of kidney function, characterized by diminution of excretory rate, increase in urinary cH, and the appearance of abnormal constituents in the urine. MacKeith and his coworkers (1923) demonstrated anuria or oliguria as a constant finding during running in man when the excretory rate had been augmented by a diuretic. They suggested that the suppression of kidney function was the result of a decreased blood supply produced by an overflow of constrictor impulses to the renal vessels. Subsequently this hypothesis was directly tested on dogs (Klisiecki et al., 1933) by denervating the kidney and measuring exercise changes in rate of urine flow. The renal nerves played no part in the inhibition of the response of the kidneys by exercise. Although in the experiments on man, diuresis was promptly resumed with the cessation of work, the suppression of excretory function markedly outlasted the period of activity in the dog. We had incidentally noted that oliguria also persisted in the human in spite of the ingestion of diuretic doses of

water administered in an effort to facilitate post-exercise urine analysis by increasing the volume of the samples voided. The object of this study was to investigate further this phenomenon in man.

Summary and Conclusion

Mild exercise has no influence on water diuresis. Post-exercise urine formation is stimulated by moderate activity. More rigorous exertion associated with breathlessness and sweating inhibits diuresis during the period of work. Brief voluntary exercise such as is accompanied by lactic acid acidosis and a large oxygen debt suppresses kidney function for 45 to 60 minutes. There is a lag of 45 minutes before the greatest excretory diminution occurs. When diuresis is resumed, the rate of urine formation may exceed that attained at rest. The prolonged arrest of diuresis after brief violent exercise cannot be attributed to failure in absorption. The hypothesis suggested is that kidney function is suppressed after violent exercise because: (1) blood is depleted of water by virtue of the increase in concentration of osmotically active components in the muscles; (2) a prolonged negative phase in blood pressure ensues; and (3) a resultant disturbance in the balance of osmotic and hydrostatic pressures reduces the volume of glomerular filtrate until the cardiovascular and physicochemical disturbances of exercise subside, 45 to 60 minutes after the cessation of muscular work.

Cardiovascular and Peripheral Vascular Diseases

Treatment by a Motorized Oscillating Bed

C. E. Sanders, M.D., Kansas City, Kansas, in J.A.M.A., 106:11:916, Mar. 14, 1936.

It has long been known that improvement in peripheral blood circulation and cardiac efficiency can be obtained by certain postural changes, utilizing the effects of gravity to facilitate the improved blood flow and tissue fluid exchange. This has been accomplished by elevation of the extremities, changing the position of the trunk, and the application of elastic pressure over the more distant portions of the circulatory tree.

Elderly patients with fractures of the lower extremities necessitating immobilization for several months developed edema that persisted for unduly long periods of time. Following the institution of postural changes in these cases, wherein the vessels were completely emptied by elevation and completely filled by lowering, the edema would rapidly disappear. Similar postural changes regularly instituted were tried, with surprisingly good results, on patients suffering from cardiac edema. The accomplishment of these postural changes in cases of cardiac insufficiency could be obtained only through active movements which are inconvenient and exhausting to the patient.

The motorized oscillating bed has been made and introduced as a convenient and comfortable method of accomplishing these postural changes regularly and systematically as well as passively on the part of the patients, who remain in a state of relaxation in bed with complete conservation of their energy.

Clinical improvement of patients treated on this oscillating bed for congestive heart failure with resultant disturbance in distribution of tissue fluid manifests itself in two ways: (a) by utilizing gravity to facilitate the return flow of blood to the heart, subsequently restoring lost muscle tone; and (b) by improvement in cardiac function. Physiologically, the so-called law of the heart may explain this fact.

In peripheral vascular diseases of diabetic, arteriosclerotic, or thrombo-angiitic types treated on this bed, marked improvement in local circulation is noted. This is indicated by a definite improvement in the temperature of the affected part as well as relief of pain. It is also noted that ulcers heal and the progress of gangrene is stopped.

The device herein presented provides a means of applying the principles of gravity to the actual treatment of patients in a convenient and comfortable manner. In brief it is a motorized hospital bed, with two speeds, which alternately elevates and lowers the head and the foot. The amplitude and rate of oscillation are adjustable in a simple manner. The motor control button is placed near the patient so that he or the attendant can interrupt the excursion at any desired position.

The Surgical Repair of Facial Nerve Paralyses: A Clinical Presentation

Arthur B. Duel, M.D., New York, in Ann. Otol. Rhin. & Laryng., 45:1:3, March, 1936.

It is now nearly six years since Sir Charles Ballance and I began to work together on the operative treatment of facial palsy. That I ever became deeply interested in it is only because of his outstanding prominence, from the very beginning, in the development of facial nerve surgery and his intriguing invitation to me to join him in further research.

I am showing you seventeen cases to demonstrate results in a cross-section of the most varying types of cases ranging from the early ones, where the under-generated graft was employed, up to the present, where only degenerated grafts are used.

The After-Care of Surgical Repair of the Facial Nerve

Thomas G. Tickle, M.D., New York, in Ann. Otol., Rhin. & Laryng., 45:1:7, March, 1936.

A word regarding the subsequent treatment of operative cases by electric stimulation. The faradic current acts only through the neurons of the facial nerve. Response to it therefore indicates that there is a connection from the central nucleus to the muscle. Response to the galvanic current takes place in muscle fiber over long periods following the complete loss of response to faradic stimulation. You all know the classical reaction of degeneration phenomena. We believe that faradic stimulation is useless except for purposes of diagnosis and do not employ it in recovering cases or in cases of partial paralysis. We think that the use of galvanic electricity, the interrupted anodal closure over the muscles of the face, for a few minutes once or twice weekly, before and after operation, is beneficial in keeping up the tone of the muscle. We do not advise operation in cases where there is no response in the muscle to galvanic stimulation. In all our cases we continue galvanic stimulation until facial movements have reached their maximum improvement. The intervals must be a matter of judgment. It is possible to overdo it. In practice it is a great help, since the patient may be kept under observation by his returning for regular treatment because he believes the continued improvement is the result of electricity. We feel that we keep the clinic patients under long observation by this method.

Foot Defectiveness in School Children

Results of the Examination of 282 School Children, Mostly Colored, in New York City

Reported by Maurice J. Lewi, M.D., President, The Foot Clinics of New York. In Public Health Reports (U. S.) 51:20:631, May 15, 1936.

As in previous surveys it was noted that postural defects accompanied mechanical defects, especially weak-foot conditions. The percentage of mechanical defects found in boys was approximately the same as that in previous surveys. It is interesting to note that in this group the percentage of mechanical defects in girls, which is usually greater by from 10 to 15 percent, was surprisingly low in this school. This is rather an unusual phenomenon and may be attributed to the fact that 95 percent of the children examined were colored, whereas in previous surveys made by this institute the children examined were either all white or predominantly white. Most of the deviations from the normal were of a character that would permit correction if properly treated.

Foot defects found among 282 school children (mostly colored) in New York City, 1936. Boys 67, girls 215.

Defect	Percent Boys	Girls
Improper mode of walking	34	32
Defective posture	37	25
Improper foot gear	58	61
Superficial defects	33	32
Weak foot	69	57
Functionally impaired anterior metatarsal arch	32	33
Hallux valgus (including all minor deflections of the great toe)	0	33

Book Reviews

AN ENQUIRY INTO PROGNOSIS IN THE NEUROSES. By T. A. Ross, M.D., F.R.C.P. Cloth. Price, $3.00. *Pp.* 192. *London, Cambridge University Press. New York, The Macmillan Company,* 1936.

In view of the ever-growing appreciation of the need for a better understanding and more effective handling of the most common of maladies, the "neuroses," the appearance of a volume on prognosis is most welcome. What can be done for this group of patients? The author has analyzed the records of 1200 cases of "psychogenic disorders" hospitalized in a modern sanitarium. Most of these patients received therapy under his personal supervision. After discussing the general aspects of the psychotherapy and management of neuroses as a group, the more specific problems of special types, such as anorexia nervosa, traumatic neuroses, obsessional-compulsional neuroses and alcoholism, are dealt with. The fate of the neurotic patient is of considerable interest. Can he be cured or is he doomed to an even darker future? Ross finds that very few patients with neuroses (50 out of 1186) become insane. He notes also that the neurotic rarely commits suicide, in contradistinction to the primary depression who is notoriously prone to self-destruction.

Half of this book is devoted to case histories and tables. Much of the information as to the course of the patient's illness was obtained through "follow-up" letters. The difficulty of evaluating such data is obvious. Relief from symptoms and modifications in the ability to make adequate adjustments to reality situations are criteria of significance. The author stresses the need for further enquiries and methods of evaluating the effects of therapy in these nervous disorders.

METHODS OF TREATMENT. By Logan Clendening, M. D., Clinical Professor of Medicine, Medical Department of University of Kansas; Attending Physician, Kansas City General Hospital; Physician to St. Luke's Hospital, Kansas City, Missouri. Cloth. Price, $10.00. *Pp.* 879. *St. Louis, C. V. Mosby Company,* 1935.

This is the fifth edition of a well known volume on medical therapy which deserves a prominent place on the medical reference bookshelf. Of particular interest to the physical therapists are excellent chapters on hydrotherapy, electrotherapy, and radiotherapy. The book is divided into two parts. Part I deals with general therapeutics including drugs, dietetics, etc. Part II is entitled "Special Therapeutics," and in it is given the treatment of infectious diseases, diseases of metabolism of the blood, cardiovascular system, digestive system, and nervous disorders. The author stresses the techniques in treatment and as a result the treatise is a very practical one. New therapies are described carefully and critically. A wealth of excellent information will be found in Clendening's "Methods of Treatment."

THERAPEUTIC USES OF INFRA-RED RAYS WITH A CHAPTER ON THE TREATMENT OF SINUSITIS BY RADIOTHERAPY. By W. Annandale Troup, M. C., M. D., Ch. B., with foreword by Sir William Willcox, K. C. I. E., C. B., M. D., F. R. C. P. Third Edition. Cloth. Price 10 *s.* 6 *d. Pp.* 151 *with* 28 *illustrations. London, The Actinic Press, Limited,* 1936.

This is a small volume on the therapeutic use of infra-red radiation. There are many excellent suggestions on the technics of this form of radiation. The book cannot be recommended to physical therapists for there are many statements that are misleading. For instance it is stated: "Screens of red or blue glass may be inserted according to various therapeutic indications." According to the available evidence there is no clinical or experimental proof that colored lights or lights transmitted through colored filters have any therapeutic or curative effect on the human being.

In considering the therapeutic effects of infra-red radiation the author is certainly optimistic when he states: "I have never yet seen a case of Bell's (facial) paralysis that will not clean up entirely after six properly-applied I. R. treatments."

HYDROTHERAPY AND CLIMATOTHERAPY. By Matthew B. Ray, D. S. O., M. D., M. R. C. P., Senior Physician, The British Red Cross Clinic for Rheumatism; Physician, the St. Marylebone and Western General Dispensary; Consulting Surgeon, Harrogate General Hospital; Late President of the Harrogate Medical Society. With a foreword by The Right Hon.

The Lord Horder, K. C. V O., M. D., F. R. C. P. Cloth. Price 12 s. 6 d. Pp. 312. London, Edward Arnold & Co., 1936.

This volume is divided into two main sections. In the first part on hydrotherapy the author gives an excellent discussion on the more important baths. Four pages are given to an incomplete consideration on electrotherapy and the remainder of this section is devoted to the action of mineral waters and the effects of spa treatment. Instead of grouping the spas according to their geographical situations or on the character of their waters, an attempt has been made to classify and describe the European spas in accordance with their main therapeutic indications in relation to those systemic conditions which are usually regarded as amenable to spa treatment.

In part two is discussed a physical agent that is often neglected. The author in considering climatotherapy first shows the influence of certain climatic elements or meteorological factors on health and then presents the climatological value of most of the health resorts in the British Isles and Europe. It is an excellent reference book on European spas and climatic resorts.

TUBERCULOSIS. By Gerald B. Webb, M. D. Former President of National Tuberculosis Association; Lecturer on Medical History, University of Colorado; President, Colorado Foundation for Research in Tuberculosis. Cloth. Pp. 205 *with* 17 *illustrations. Price* $2.00. *New York, Paul B. Hoeber, Inc.,* 1936.

This volume is one of a series of handbooks under the general title of "Clio Medica." It is surprising how much of interest to physical therapists is contained in each of these volumes. This volume presents in a concise and readable form the history of tuberculosis.

It is of interest to hear that a prehistoric day statuette discovered in the Assouan Desert of Higher Egypt is portrayed taking a sand bath in the sun. In the pictographs of the pre-Columbia cliff dwellers is portrayed the unmistakable picture of Pott's disease. The patients are usually lying on their backs, and playing the flute, a suggestion of occupational therapy.

Pliny advised sea voyages for phthisis and believed the "puking" of seasickness was beneficial to the chest. He also announced: "Sol est remediorum maximum" ("The sun is the greatest of remedies"). Cato the Elder was an exponent of a lukewarm bath of urine from a person who had eaten cabbage as an infallible cure for phthisis.

John Wesley (1703-1791) recommended cold bathing and breathing into a hole cut in the fresh earth as a cure for consumption. Equitation had its special advocate in Sydenham. Hyperpyrexia by heavy bed clothes was employed by Petron. The use of dry cupping and counterirritants continued through all ages.

This volume contains many references to the use of physical agents in the treatment of tuberculosis from prehistoric times to our own times when Rollier and Finsen wrote their original works. It can be recommended to every physical therapist.

PASSIVE VASCULAR EXERCISES AND THE CONSERVATIVE MANAGEMENT OF OBLITERATIVE ARTERIAL DISEASES OF THE EXTREMITIES. By Louis G. Herrmann, A. B., M. D., Assistant Professor of Surgery, College of Medicine of the University of Cincinnati and the Cincinnati General Hospital; Director of the Vascular Disease Clinics of the Cincinnati General Hospital and the Christian R. Holmes Hospital of the University of Cincinnati. Cloth. Price $5.00. *Pp.* 228 *with* 80 *illustrations and* 4 *colored plates. Phila., J. B. Lippincott Company,* 1936.

This book is a complete monograph on the treatment of obliterative arterial diseases of the extremities by the conservative methods. There is an interesting chapter on the historical development of knowledge concerning physiologic effects of changes in environmental air pressure upon peripheral arterial circulation. Here it is shown that in 1798 Nathan Smith of England found a vapour bath to which he had attached an air pump to be an efficient means of treatment.

The physiology of the peripheral distribution of blood and the physiologic effects of rhythmic alternation of environmental air pressure are considered. Following this there are chapters on the collateral arterial circulation in the human extremities and the general management of peripheral vascular disturbances. The final one hundred pages are devoted to the passive vascular exercise method of therapy. Dr. Herrmann in 1932 designed and built a machine to treat obliterative arterial diseases of the extremities by an alteration of the environmental pressure. This machine is known as the Pavaex (passive vascular exerciser) Unit.

This method of treatment with this machine and others of the same type is being used in many hospitals under the control of the peripheral vascular clinics and the physical therapy departments. It is therefore necessary for physical therapists to know this form of physical therapy. This book is recommended to all physical therapists who are interested in the field of vascular diseases.

Medicine is an art as well as a science. It is necessary not only to cure the disease but to cure the patient, whose comfort of mind and body is always paramount.

From the Northwestern University Medical School Founders' Day address by Dr. Leslie B. Arey, October 2, 1934.

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